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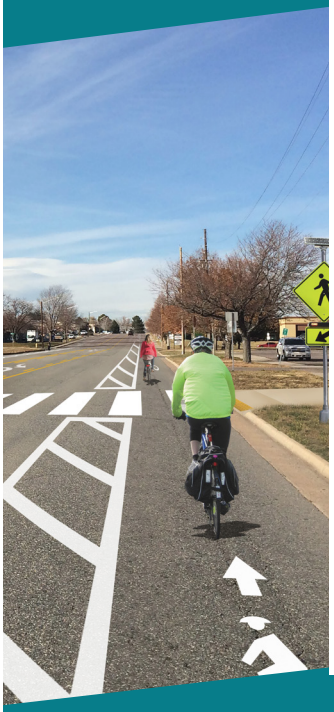

Northglenn

BICYCLE AND PEDESTRIAN MASTER PLAN

APPENDICES

January 2018

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BICYCLE AND PEDESTRIAN MASTER PLAN

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APPENDIX A:

BICYCLE AND PEDESTRIAN SUITABILITY ANALYSIS METHODS

Appendix A: Bicycle and Pedestrian Suitability Analysis Methods

LEVEL OF TRAFFIC STRESS (LTS) ANALYSIS

The Level of Traffic Stress Analysis is adapted from the 2012 Mineta Transportation Institute *Report 11-19: Low-Stress Bicycling and Network Connectivity*. A level of comfort for bicyclists is determined based on factors including posted speed limit, street width, crossing conditions, and the presence and character of bicycle facilities. The combination of these criteria assigns scores to roadways on a four-point scale:

- **LTS 1:** Low-stress roadways suitable for all ages and abilities; also includes paved shared use paths
- **LTS 2:** Roadways that are comfortable enough that the mainstream adult population would ride a bicycle on them
- **LTS 3:** Roadways that are probably only be comfortable when ridden by an experienced, confident bicyclist
- **LTS 4:** Roadways ridden only by strong or fearless bicyclists

In general, a separated bicycle facility, would qualify as a low-stress (LTS 1) bikeway, while roadways shared with motor vehicle traffic operating at high posted speeds would receive a higher-stress score. The results of the LTS analysis help identify existing areas with a high level of service as well as focus areas for improvement.

LTS provides an intuitive framework to describe the benefits of bicycle infrastructure, and demonstrates that some roadways need more intervention than others to provide a truly comfortable experience. Table A.1 presents the scoring framework for the analysis; additional assumptions are included after the table.

Table A.1: Criteria for Level of Traffic Stress in Mixed Traffic[1]

Prevailing Speed or Speed Limit (mph)	Unmarked Centerline or Residential	1 lane per direction	2 lanes per direction	3+ lanes per direction
≤ 25[2]	LTS 1	LTS 2	LTS 3	LTS 4
30	LTS 2	LTS 3	LTS 4	LTS 4
≥ 35	LTS 4	LTS 4	LTS 4	LTS 4

[1] Table adapted from MTI Low-Stress Bicycling and Network Connectivity report. Note the report includes additional scoring tables for roadways with on-street bicycling facilities. Since no such facilities exist in Northglenn, all roadways are scored using Table A.1.

The LTS Analysis for Northglenn included the following assumptions:

- Where speed limit data was not available, local roadways are assumed to have a posted speed of 25
- Where speed limit data was not available, Alta verified posted speeds on collector and arterial roadways using aerial imagery

PEDESTRIAN LEVEL OF SERVICE (PLOS) ANALYSIS

The Pedestrian Level of Service (PLOS) analysis considers safety of the pedestrian environment along all roadways. The standard analysis is based on injury potential related to vehicle speed[2], and further assesses separation from motor vehicle traffic as a method for improving comfort. The analysis includes the following data inputs: posted speed limit, number of travel lanes, sidewalk presence (no sidewalk, one side only, both sides of roadway), and presence of a buffer.

A field review of the results determined that land use has a significant impact on comfort level throughout the city. For this reason, the *Land Use Adjustment* table included in Chapter 14 of the Oregon Department of Transportation *Analysis Procedures Manual* was applied to the results as an adjustment factor. The PLOS scores for roadways within light industrial, automobile-oriented commercial, and freeway interchange zones are increased by 1 point. [3]

The PLOS results represent four categories based on the combination of lanes, sidewalk and buffer presence, posted speeds, and roadway context.[4]

- **PLOS 1:** Residential streets with sidewalks OR multi-lane roadways with buffered sidewalks both sides
- **PLOS 2:** Multi-lane roadways with low-to-moderate posted speeds and attached sidewalks both sides OR that have a buffered sidewalk on one side
- **PLOS 3:** Multi-lane roadways with moderate posted speeds and attached sidewalks OR that have a sidewalk on only one side of the road
- **PLOS 4:** Multi-lane roadways with higher speeds and attached sidewalks OR that lack sidewalks on one or both sides of the road

[2] Tefft, B. C. Impact speed and a pedestrian's risk of severe injury or death. Accident Analysis & Prevention 50 (2013) 871-878.
[3] For commercial/industrial adjustments, land use codes used include C1, C3, C4, C5, and I2. Zones selected based on reading code and visual inspection of areas. Freeway interchange area identified via aerial.
[4] The PLOS analysis results in scores from 1 to 5; however, no roadways in Northglenn qualified for a PLOS score of 5, and therefore the definition of this PLOS score is omitted

Table A.2 presents the scoring framework for the analysis; additional assumptions are included below:

Table A. 2: Criteria for Pedestrian Level of Service[5]

Pedestrian Space	Posted Speed Limit (mph)					
	<= 25 mph		30 - 35 mph		>= 40 mph	
	<=2 lanes	> 2 lanes	<=2 lanes	> 2 lanes	<=2 lanes	> 2 lanes
Complete sidewalk on both sides next to a buffer	1	1	1	1	2	3
Complete sidewalk on both sides	1	1	2	3	3	4
Complete sidewalk on one side next to a buffer	2	2	2	3	3	4
Complete sidewalk on one side	2	3	3	4	4	5
No dedicated space	2	3	4	5	5	5

Additional assumptions made during the analysis include:

- Where speed limit data was not available, local roadways are assumed to have a posted speed of 25
- Where speed limit data was not available, Alta verified posted speeds on collector and arterial roadways using aerial imagery

[5] For roadways within light industrial, automobile-oriented commercial, and freeway interchange zones, PLOS scores are increased by 1 point

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APPENDIX B:

EQUITY ANALYSIS METHODOLOGY

Appendix B: Equity Analysis Methodology

EQUITY ANALYSIS BACKGROUND

Transportation facilities are essential components in creating communities of opportunity and reducing the disproportionate economic and health burdens on communities of concern.[4] Often, traditionally vulnerable populations, such as children, older adults, people of color, people with limited English proficiency, and low-income individuals rely heavily on affordable transportation options, specifically walking, bicycling, and transit.[1–3] A lack of high-quality walking, bicycling, and transit facilities can result in unsafe travel conditions and/or long travel times.

For Alta's equity analysis process, we have defined the following equity indicators, which are factors derived from United States Census data that have historically been connected to disadvantaged and vulnerable populations, including: concentrations of children, older adults, people of color, people with limited English proficiency, households with no access to a vehicle, and low-income individuals. Equity is particularly important for these groups because of their common reliance on active and public transportation, which renders them more vulnerable to poor bicycling and walking infrastructure.

Alta's equity analysis identifies where the majority of individuals within each indicator reside within Northglenn. Understanding where these individuals are most densely located helps to prioritize transportation improvements to address historic inequities. Increasing active transportation access for communities that most depend on it improves access to life-enhancing services and opportunities.

The U.S. Department of Housing and Urban Development (HUD) uses an alternative methodology to identify potential areas with vulnerable populations, using low-to-moderate income (LMI) levels. This analysis is used to identify projects that may qualify for HUD's Community Development Block Grant (CDBG) Program. The Alta equity analysis includes more factors, and therefore is a more comprehensive representation of potential vulnerable populations. For comparison, Figure B.7 displays the results of the CDBG LMI method.

METHODS

The project team conducted an equity analysis using existing demographic information from the United States Census Bureau. All data was obtained from the 2011 to 2015 American Community Survey (ACS) 5-year estimates and analysis was conducted at the Census Block Group level for Northglenn. Each of the six indicators received equal weight in determining the composite equity score. For this analysis, the following indicators were used:

- **Age**: Individuals under the age of 18 and over the age of 65 comprise this indicator.
- **Race**: This indicator measures the percentage of the population that identifies as non-white.

- **Income**: This indicator measures individuals of working age living at or below 200% of the Federal Poverty Level, which is a threshold set by the United States Census Bureau and is updated annually.
- **Educational Attainment**: This indicator represents the percentage of the population over 25 years of age that does not have a high school diploma or equivalent.
- **Limited English Proficiency (LEP)**: This indicator measures the percentage of the population that identifies as not speaking English well or at all.
- **Access to a Vehicle:** This indicator measures the percentage of households who do not have regular access to a vehicle.

The composite equity analysis results identify areas that demonstrate a relative need for transportation investments based on concentrations of the populations listed above. The composite map is developed based upon results for each census block compared to all census blocks within Northglenn. This isolates census blocks that have relative need identified through these indicators compared to other census blocks in the community. For each census block, the composite equity score reflects the distance from the mean of the comparative geography.

While this analysis does not directly assess access to existing facilities, the results identify areas where more facilities may be needed or access to existing facilities should be improved. The project team used the composite equity map to identify focus areas for new investments that may address equity needs.

EQUITY ANALYSIS METRIC RATIONALE

The following discussion explains why each indicator is utilized.

Age: Under 18

Rationale: The population under 18 years of age is thought to have higher active transportation infrastructure need because they have less access to motor vehicles and may rely more on alternative modes of transportation. Other youth-related vulnerabilities may include lacking knowledge of safe travel behaviors; greater susceptibility to environmental exposures, such as damage caused to developing bodies through emissions; and difficulty navigating poorly-designed areas.[1] Youth especially need safe transportation to/from places to be physically active and to build social connections.[1] Research on transportation facilities shows that road design and sidewalk conditions determine youth physical activity; safe crossings, well-built sidewalks, and traffic calming strategies are all associated with greater physical activity in youth.[11] Promoting physical activity in youth is important for physical and social development, boosting academic achievement and self-esteem, and preventing costly chronic diseases.[12] Further, physical and cognitive development impact a child's ability to safely walk and bicycle in a high traffic scenario.[30,31] This means that children, and younger children in particular, lack proficiency in actions such as scanning for traffic and identifying safe locations for crossing. Areas with high concentrations of youth populations will benefit from improved crossing conditions.

Age: Over 65

Rationale: The population over 65 years of age may have more mobility needs than the general adult population, specifically in that they may require more alternatives to driving. Older adults increasingly depend on active transportation modes, such as public transit, walking and/or bicycling when they decrease or stop driving. Prioritizing active transportation needs enables older adults to maintain positive well-being, despite the onset of functional limitations.[13] Walkable access to adequate public transportation is essential for older adults to maintain their daily activities and independence.[14] Additionally, safe, walkable communities that promote physical activity help prevent or delay chronic diseases such as arthritis, osteoporosis and diabetes in older adults.[15] As 61% of American adults ages 65 years or older have at least one activity-based limitation, creating communities where older adults can safely be active and access necessary resources is crucial to the future prevention of such disability.[16] Lastly, older adults are especially vulnerable to social isolation, which can result in significant declines in physical health; increasing walkability enhances older adults' ability to connect with others.[2,14]

Income: Poverty

Rationale: Poverty is a socioeconomic vulnerability, linked with disproportionate exposure to poor housing, homelessness, and limited access to resources, such as transportation services, quality food, recreation facilities and health care facilities.[1,17,18] With transportation costs, especially those associated with vehicle ownership, often comprising the second largest portion of an individual's income (second to housing), reduced access to transit and active transportation networks may lead to greater reliance on an automobile and therefore have significant financial impacts on poor households.[29] Populations with higher levels of poverty may have limited access to vehicles and rely more on active transportation networks to access daily trips. Of U.S. residents with incomes at or below 200% of the Federal Poverty Level (FPL), 32% overall do not have access to a household vehicle.[7] Comparatively, 55% of Black and 39% of Hispanic individuals at or below the 200% FPL do not have such access.[7] Even with increased dependence on non-automotive transportation, low-income residential areas are often less walkable, a condition that creates barriers to living safe, social, and active lives.[1,18] Lastly, children living in low socioeconomic status areas are more likely to experience traffic injuries and more likely to die from traffic injuries than children in more affluent areas.[19] Increasing low-income residents' active transportation facilities can improve access to economic and educational opportunities, improve health through increased physical activity, and promote safety.[20,21]

Race: Non-White Population

Rationale: Racial or ethnic minorities are more likely to live in areas with poor or limited active transportation facilities, educational opportunities, job resources, and healthy food outlets.[1,6] They tend to be more dependent on transit and active transportation; black individuals are more than four times and Hispanics three times as likely, to not have access to a household car compared to their white counterparts, regardless of income.[7] In turn, these deficits exacerbate the disproportionate health burdens communities of color experience. Lastly, communities of color experience a greater proportion of pedestrian crashes and have increased risk of mortality after pedestrian injury.[9,10] Therefore, increasing active transportation facilities and connectivity may promote physical activity, enhance economic opportunities, and increase transportation safety.

Education: No High School Diploma or Equivalent

Rationale: Nationwide those without high school diplomas have the highest rates of walking and the second highest rates of bicycling to and from work.[3] These individuals may depend on walking and bicycling due to financial constraints and lack of adequate and/or convenient transportation options. Educational attainment, as a socioeconomic indicator, correlates with income levels. Therefore, although this population is most likely to walk to work, individuals without high school diplomas tend to live in areas without adequate bicycling and walking facilities.[1] Boosting active transportation resources in these areas could promote increased access to educational resources and job opportunities.

Limited English Proficiency

Rationale: Individuals with Limited-English Proficiency (LEP), or who identify as not speaking English well or at all, tend to rely more on active transportation as their primary means of transportation than the average English speaker.[20,22] General low economic status of LEP individuals may correlate with low car ownership rates and high reliance on active transportation facilities.[23] Given low car ownership and poor active transportation conditions, immigrants and LEP individuals are more likely to walk and ride along roads that lack appropriate bicycling and walking facilities, forcing individuals into unsafe transportation situations.[20] Therefore, access to active transportation services is critical for LEP individuals to access basic employment and other necessities.[23] Further, LEP individuals are less likely to participate in decision-making processes, in part due to barriers caused by limited English proficiency and in part due to the correlation with low-income status and implications of work schedule.[24]

Access to a Motor Vehicle

Rationale: In suburban locations, specifically those with limited transit access and coverage, access to a motor vehicle carries strong implications for one's ability to reach employment, access healthy foods, and reach basic services.[27] A diverse transportation system that offers multiple modes, including transit, bicycling, and walking, reduces reliance on automobiles and can provide for more equitable access to services.[20] Providing access via quality walking and bicycling infrastructure is one method for increasing equity in locations with limited vehicle availability.[20] Studies have also found that access to a motor vehicle improves employment rates, as it provides a reliable means to commute to work.[27] The addition of safe and comfortable walking and bicycling routes, as well as developing improved connections to transit, have the ability to also serve as a reliable means to commute to work.

EQUITY ANALYSIS INDICATOR MAPS

The individual equity indicators described in this appendix are combined to produce the composite equity scores presented in Chapter Three of Connect Northglenn. Maps displaying the individual equity indicators are displayed on pages 5 – 7. These maps illustrate the percentage of the Northglenn's population that meets the criteria for each variable by census block group.[1]

[1] The statistical method used to create the percentage categories is Natural Jenks, which uses natural breaks in the data to create the four classes of percentages.

Figure B.1. Percentage of Population Under 18 Yand Over 65 Years of Age

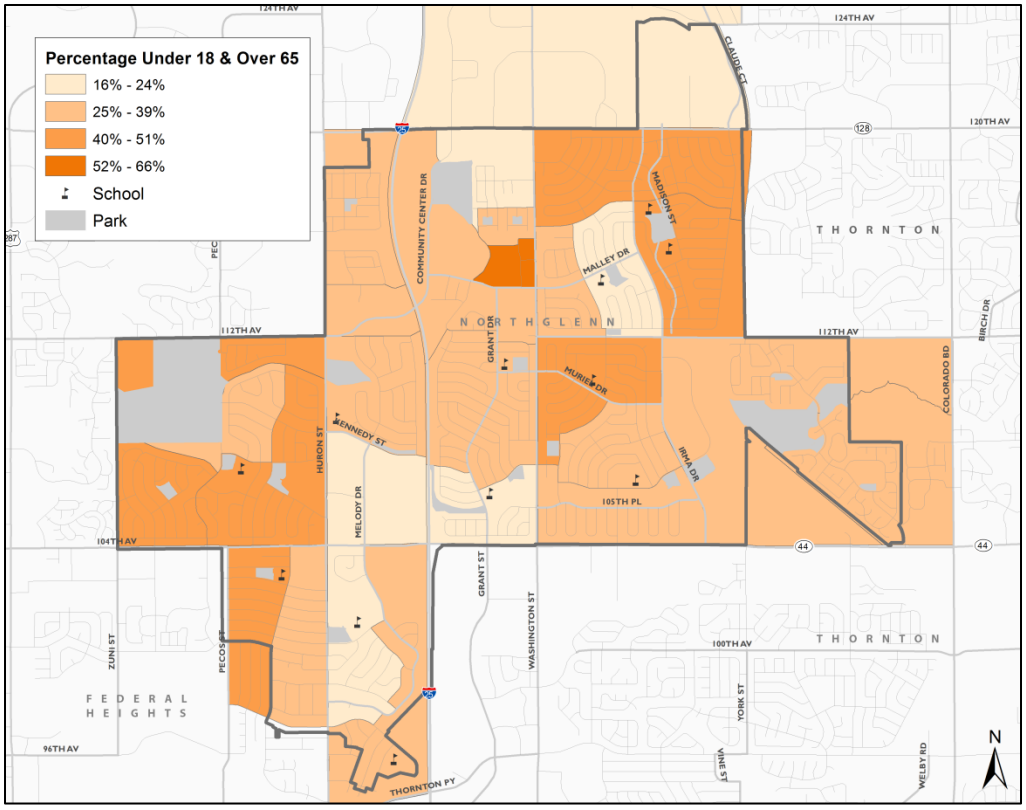


Figure B.2. Percentage of Individuals of Working Age Living At or Below 200% Federal Poverty Level

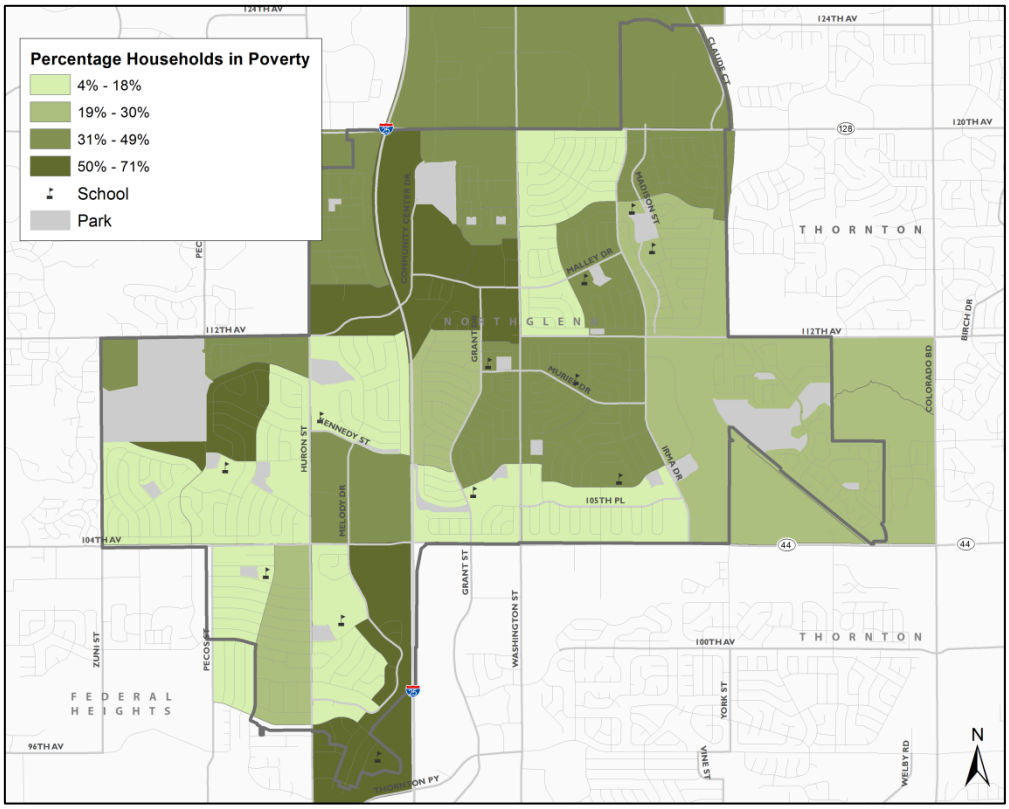


Figure B.4. Percentage of Population that Identifies as Non-White

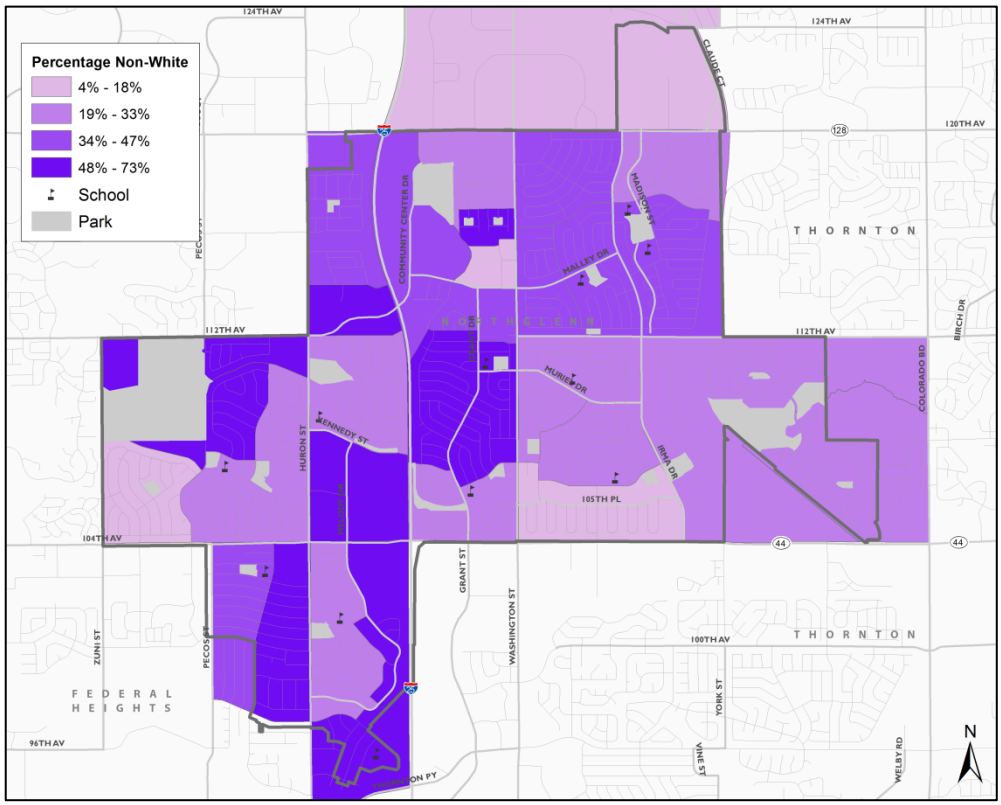


Figure B.3. Percentage of Population Over 25 Years of Age Without a High School Diploma or Equivalent

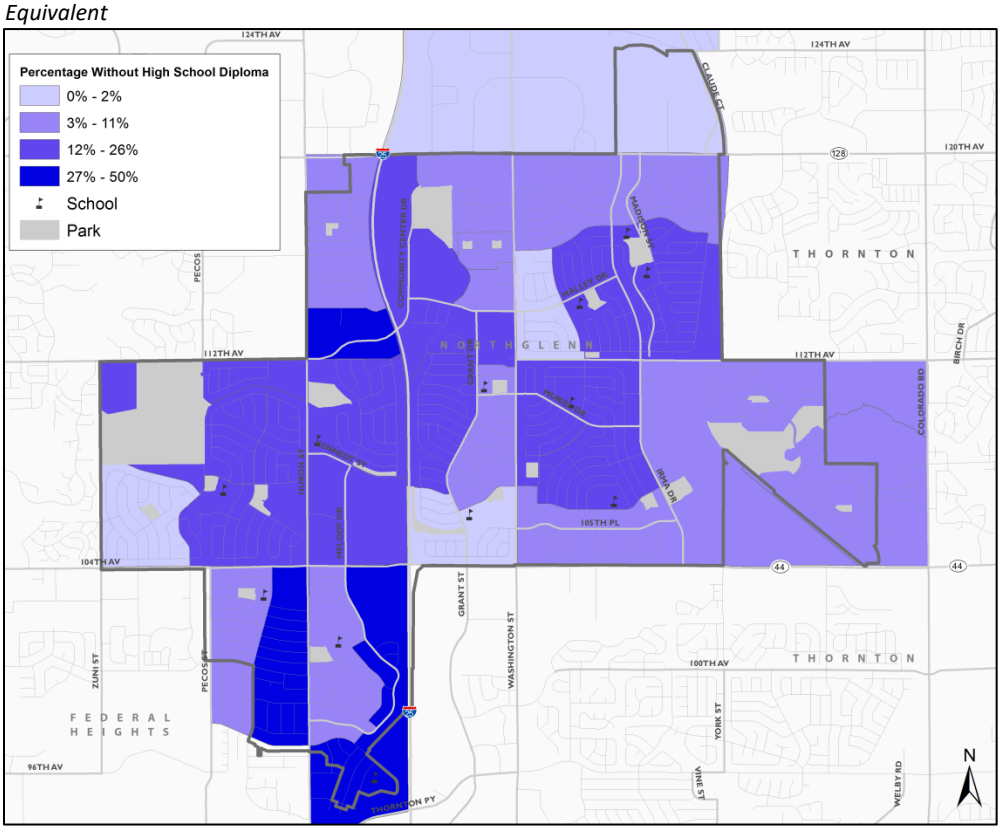


Figure B.6. Percentage of Population with Limited English Proficiency

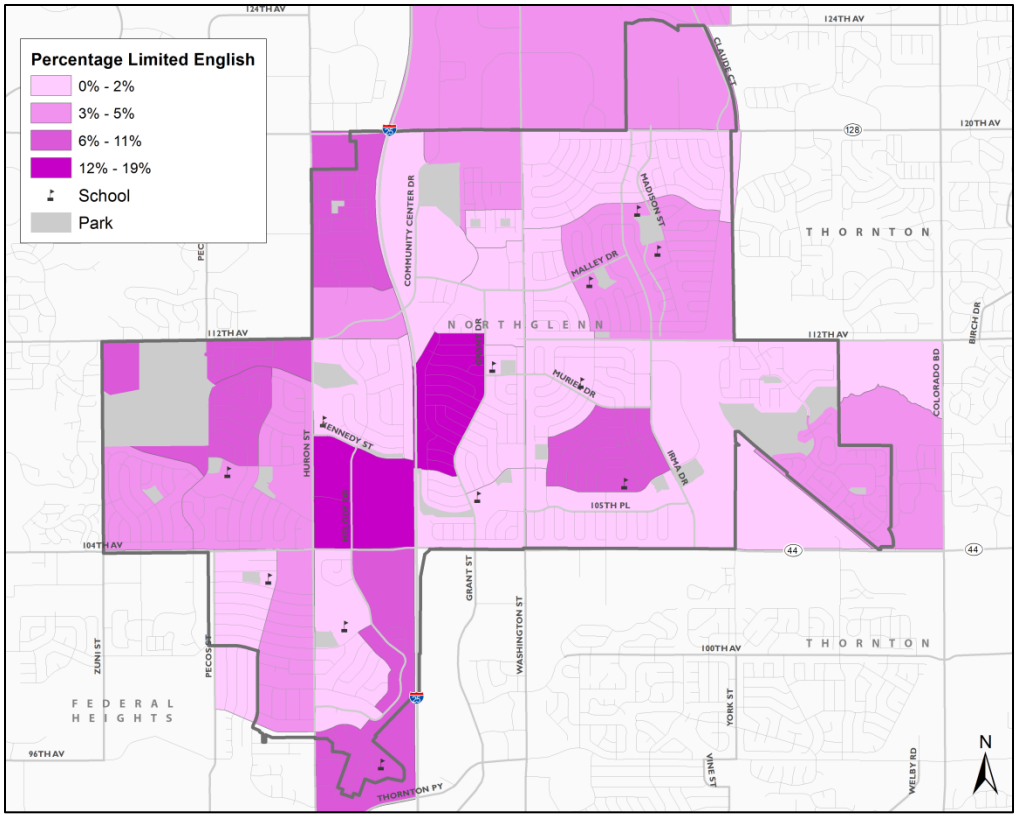


Figure B.5. Percentage of Households without Regular Access to a Motor Vehicle

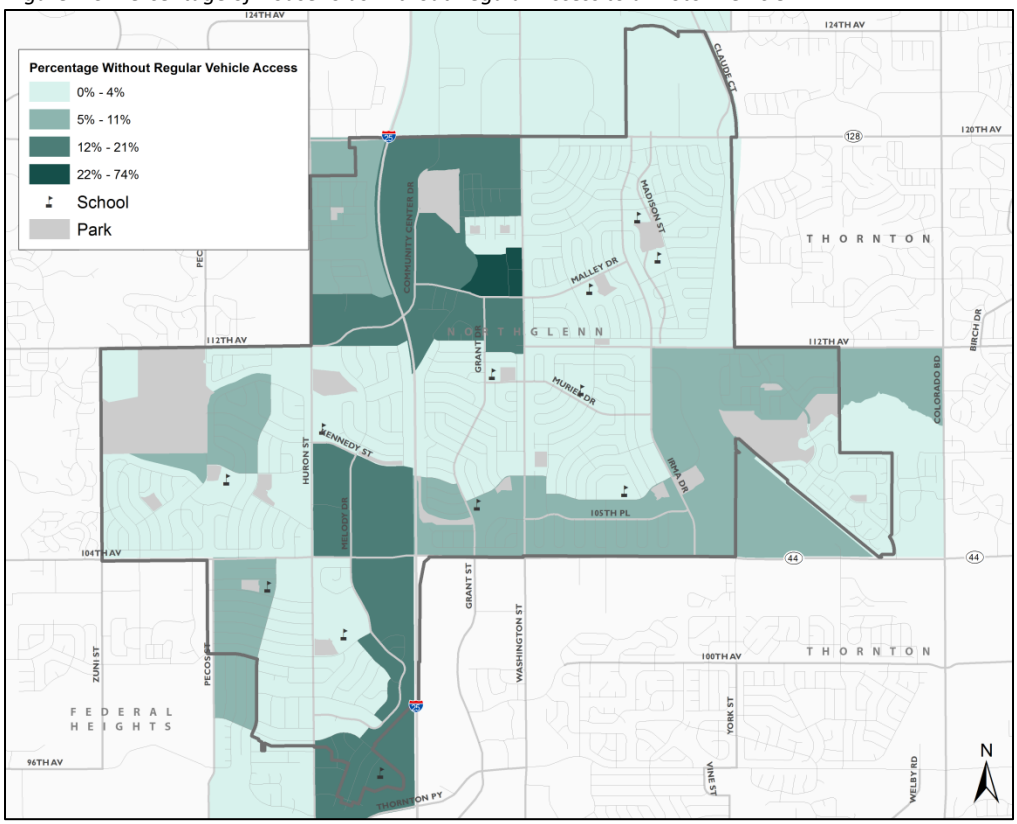
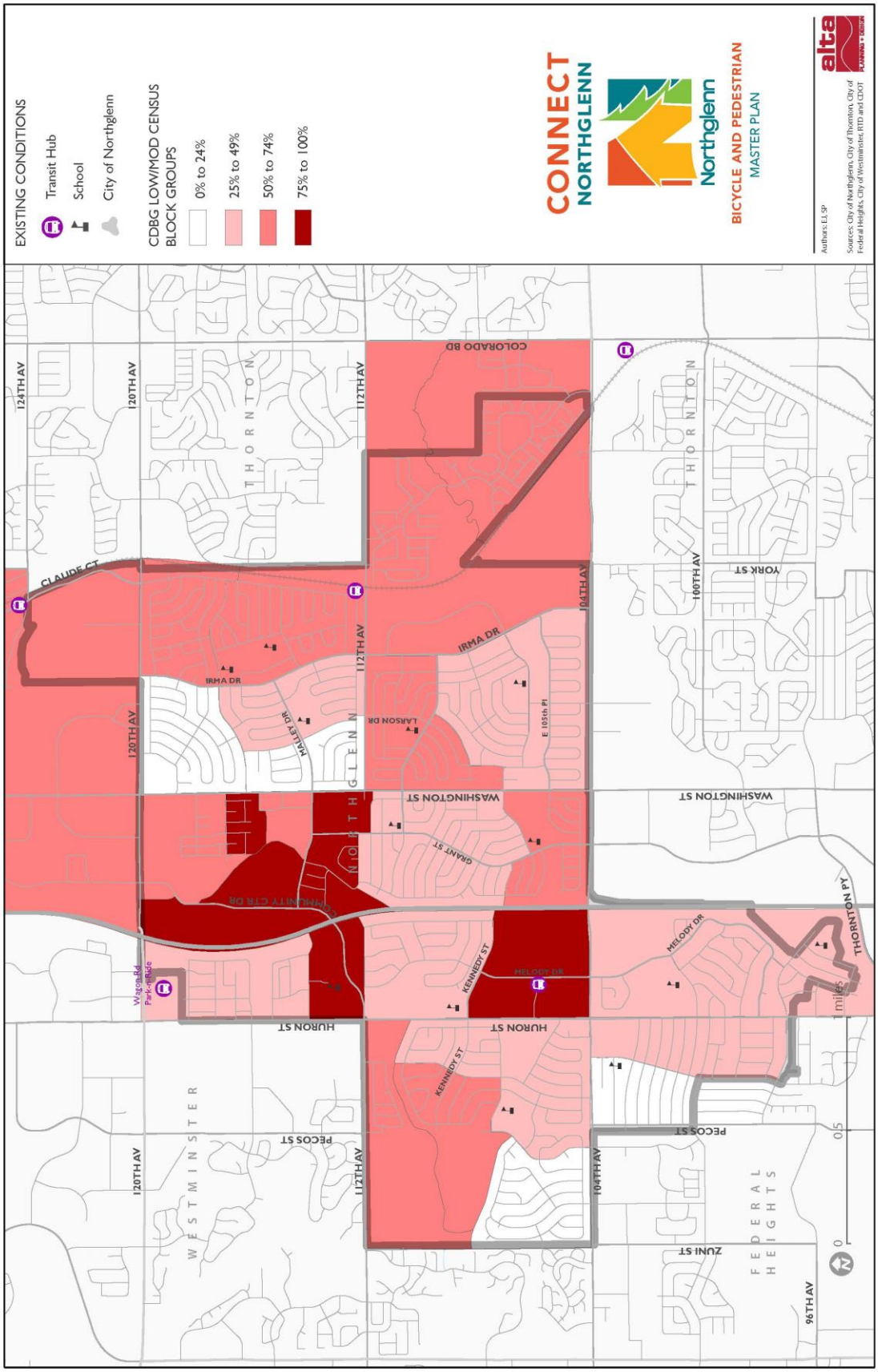


Figure B.7. Low-to-Moderate Income Census Block Groups, Northglenn



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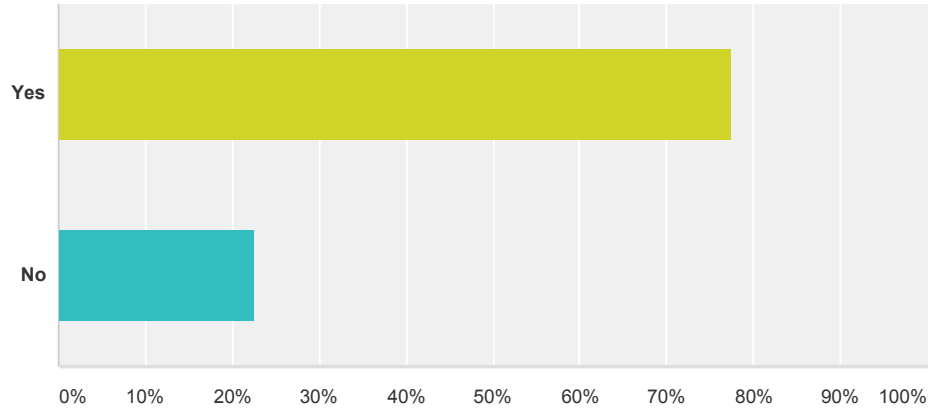
APPENDIX C:

ONLINE SURVEY RESULTS

Q1 Are you a Northglenn resident?

Answered: 168 Skipped: 2



Answer Choices	Responses	
Yes	**77.38%**	130
No	**22.62%**	38
Total		**168**

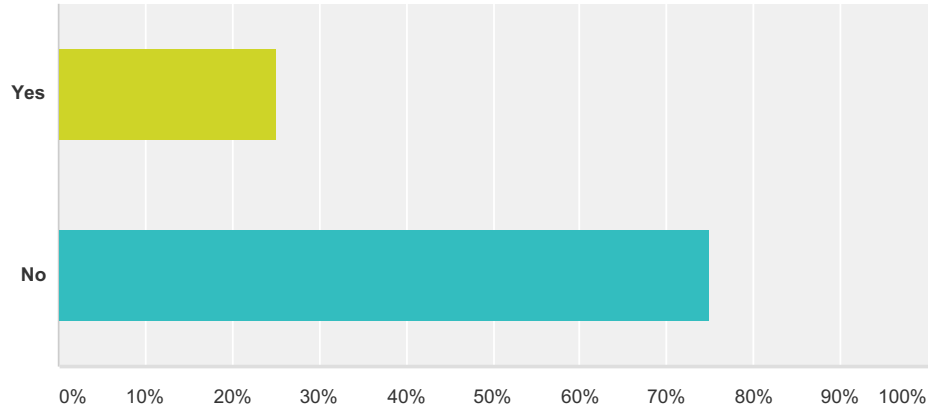
Q2 What is your residential zip code? This information will remain anonymous and will not be shared with anyone. By knowing respondents' zip codes, the project team can understand where we are collecting input from.

Answered: 170 Skipped: 0

Zip Code	Count	Percentage
80233	89	52%
80234	28	16%
80260	17	10%
80241	16	9%
80602	4	2%
80004	2	1%
80020	2	1%
80229	2	1%
80013	1	1%
80021	1	1%
80022	1	1%
80023	1	1%
80214	1	1%
80228	1	1%
80244	1	1%
80333	1	1%
80537	1	1%
80601	1	1%

Q3 Do you work in Northglenn?

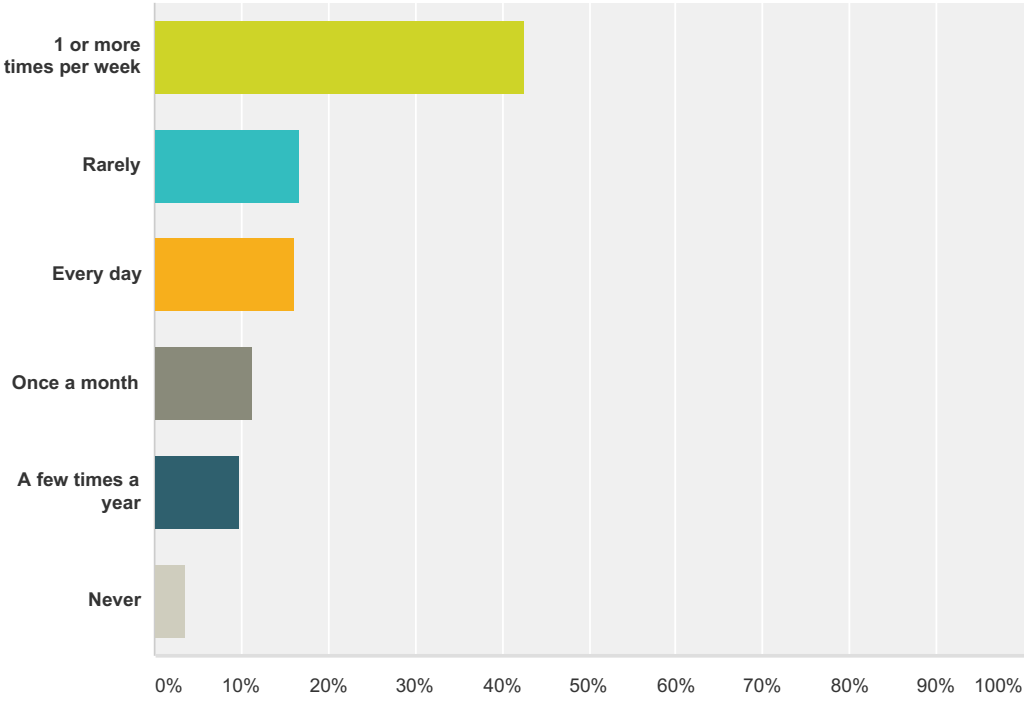
Answered: 168 Skipped: 2



Answer Choices	Responses	
Yes	**25.00%**	42
No	**75.00%**	126
Total		**168**

Q4 How often do you walk to get from one place to another in Northglenn? This includes trips such as walking to lunch, the gym, a bus stop, school, etc.

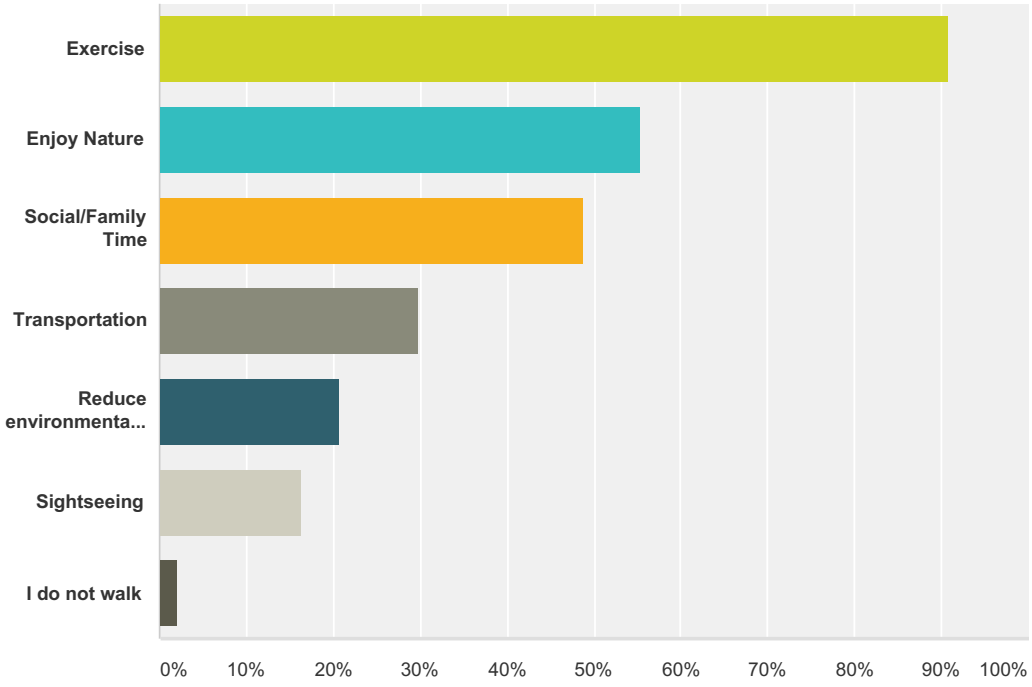
Answered: 143 Skipped: 27



Answer Choices	Responses	
1 or more times per week	**42.66%**	61
Rarely	**16.78%**	24
Every day	**16.08%**	23
Once a month	**11.19%**	16
A few times a year	**9.79%**	14
Never	**3.50%**	5
Total		**143**

Q5 For what reasons do you walk? Choose all that apply.

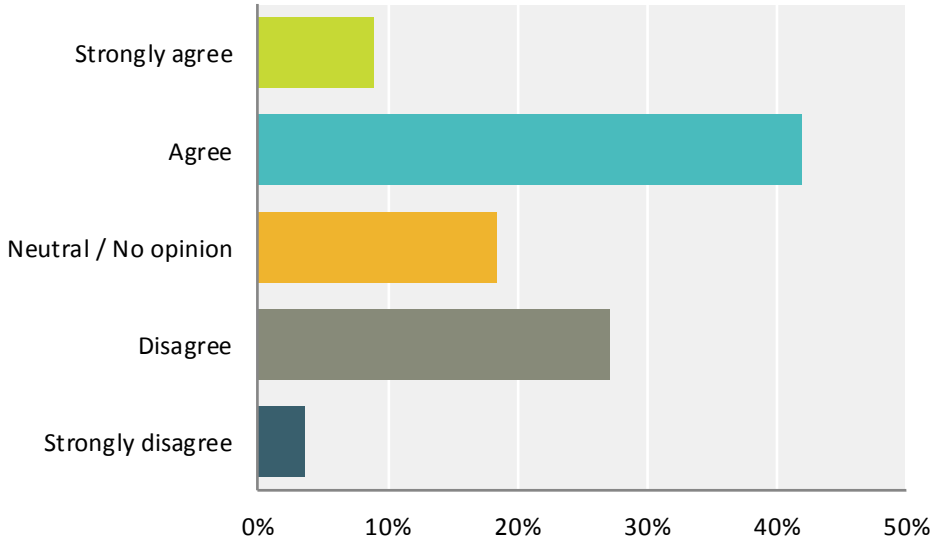
Answered: 141 Skipped: 29



Answer Choices	Responses	
Exercise	**90.78%**	128
Enjoy Nature	**55.32%**	78
Social/Family Time	**48.94%**	69
Transportation	**29.79%**	42
Reduce environmental impact	**20.57%**	29
Sightseeing	**16.31%**	23
I do not walk	**2.13%**	3
Total Respondents: 141		

Q6 What is your opinion of the following statement: "Walking (including using an assistive mobility device) in Northglenn is a safe, practical, and convenient way to get from one place to another." Skip this question if you do not walk.

Answered: 136 Skipped: 34



	Strongly agree	Agree	Neutral / No opinion	Disagree	Strongly disagree	Total	Weighted Average
(no label)	**8.82%** 12	**41.91%** 57	**18.38%** 25	**27.21%** 37	**3.68%** 5	136	2.75

Q7 What destinations would you most like to safely walk to in Northglenn? Rank your top 5 choices.

Answered: 141 Skipped: 29

Answer Choices (Most Desirable to Less Desirable)	Weighted Average
Parks and trails	105.6
Community Event (Movies in the Park, Food Truck Festival, 4th of July, Magic Fest, etc.)	74.4
Grocery stores and farmers markets	61.8
Commercial districts and retail shops	50.4
School (including college buildings)	34.0
Bus stops	27.4
Social services and government buildings (City Hall, social security office, etc.)	21.6
Work	15.8
Church	10.2

Q8 Which of the following infrastructure improvements would make Northglenn a safer and friendlier place for walking? Choose the 3 that would have the most positive impact.

Answered: 141 Skipped: 29

Answer Choices (Most positive impact to less positive impact)	Weighted Average
Install more trails and greenways	59.3
Construct wider sidewalks/sidewalks with a buffer	46.7
Make intersections and crossings safer	43.3
Fill gaps in existing sidewalk network	34.7
Improve street lighting and benches	27.3
Slow traffic by using raised medians, speed tables, and curb extensions	17.0
Install more frequent marked crosswalks	16.0
Install pedestrian wayfinding signage	11.7
Decrease speed limits on certain roads	10.3
Improve Americans with Disabilities Act (ADA) accessibility	9.0

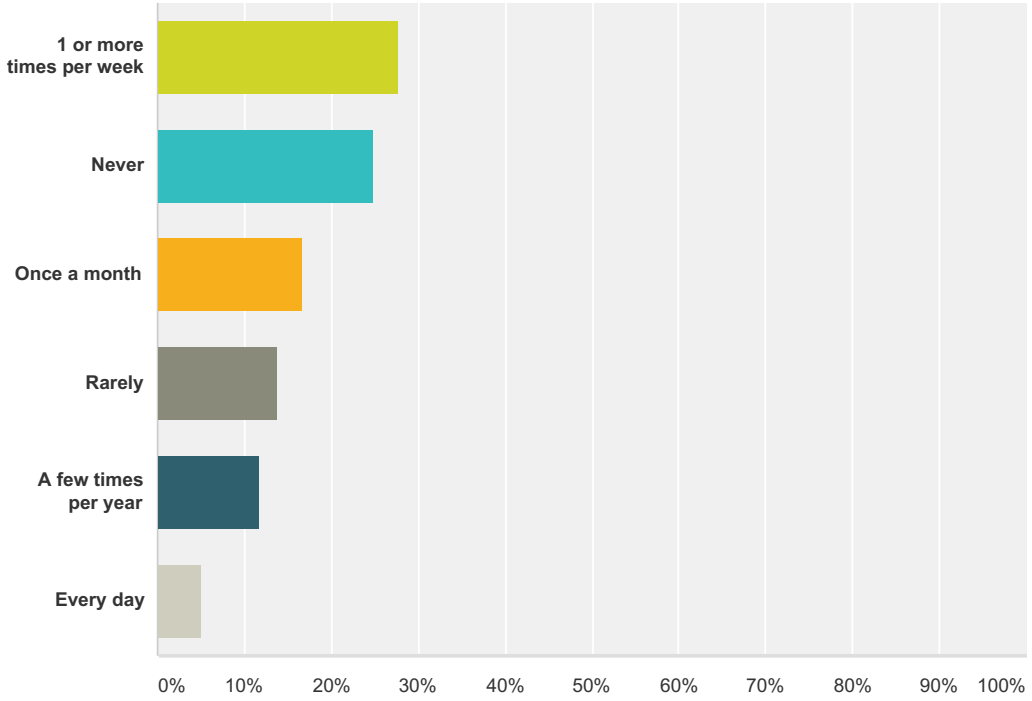
Q9 Which of the following policy and program initiatives would make Northglenn a safer and friendlier place for walking? Choose the 3 that would have the most positive impact.

Answered: 140 Skipped: 30

Answer Choices (Most positive impact to less positive impact)	Weighted Average
Develop walking-focused maps that show comfortable routes for walking to local destinations	68.7
Increase law enforcement of drivers yielding to pedestrians	52.3
Plan "Open streets" events, where a street is temporarily closed to car traffic and open to walking and other activities	48.7
Develop programs for children/families to facilitate walking to school	44.7
Develop media campaign to educate drivers regarding pedestrian safety	28.7
Develop media campaign to educate pedestrians on safe walking habits	20.3
Increase law enforcement of jaywalkers	9.3

Q10 How often do you bike to get from one place to another in Northglenn? This includes trips such as biking to work, the gym, a bus stop, school, etc.

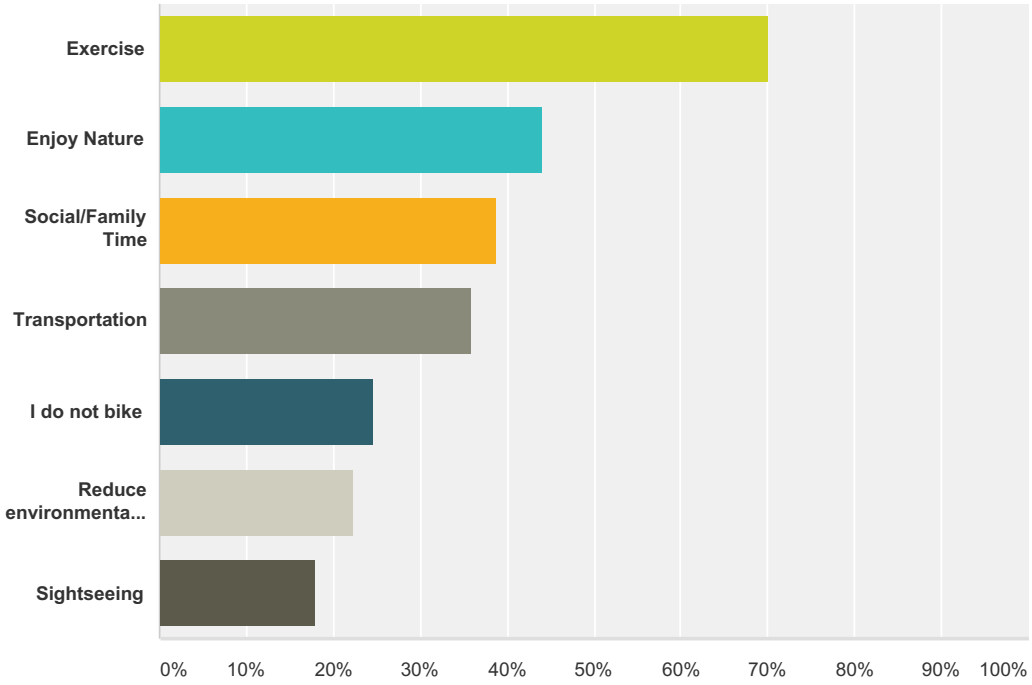
Answered: 137 Skipped: 33



Answer Choices	Responses	
1 or more times per week	**27.74%**	38
Never	**24.82%**	34
Once a month	**16.79%**	23
Rarely	**13.87%**	19
A few times per year	**11.68%**	16
Every day	**5.11%**	7
Total		**137**

Q11 For what reasons do you bike? Choose all that apply.

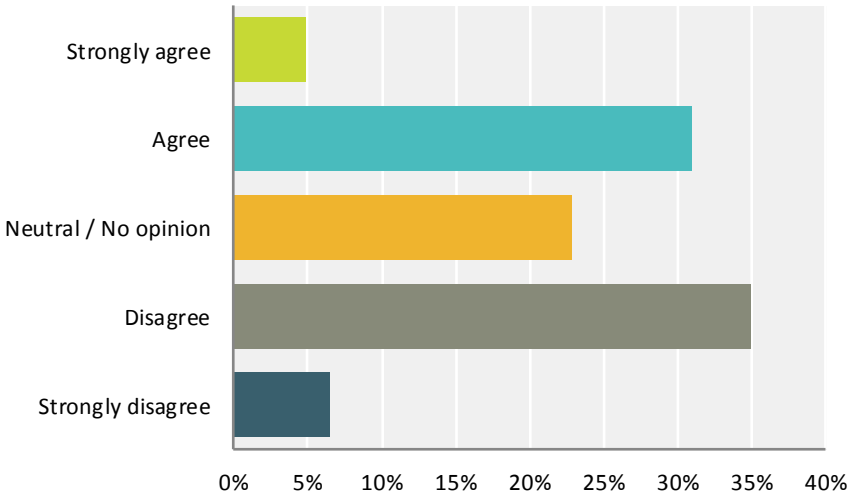
Answered: 134 Skipped: 36



Answer Choices	Responses	
Exercise	**70.15%**	94
Enjoy Nature	**44.03%**	59
Social/Family Time	**38.81%**	52
Transportation	**35.82%**	48
I do not bike	**24.63%**	33
Reduce environmental impact	**22.39%**	30
Sightseeing	**17.91%**	24
Total Respondents: 134		

Q12 What is your opinion of the following statement: "Biking in Northglenn is a safe, practical, and convenient way to get from one place to another." Skip this question if you do not bike.

Answered: 123 Skipped: 47



	Strongly agree	Agree	Neutral / No opinion	Disagree	Strongly disagree	Total	Weighted Average
(no label)	**4.88%** 6	**30.89%** 38	**22.76%** 28	**34.96%** 43	**6.50%** 8	123	3.07

Q13 What destinations would you most like to safely bike to in Northglenn? (Rank your top 5 choices)

Answered: 122 Skipped: 48

Answer Choices (Most desirable to less desirable)	Weighted Average
Parks and trails	94.8
Community Event (Movies in the Park, Food Truck Festival, 4th of July, Magic Fest, etc.)	61.8
Grocery stores and farmers markets	53.6
Commercial districts and retail shops	48
School (including college buildings)	27.4
Work	24.6
Bus stops	15.4
Social services and government buildings (town hall, social security office, etc.)	12.4
Church	4.6

Q14 Which of the following infrastructure improvements would make Northglenn a safer and friendlier place for biking? Choose the 3 that would have the most positive impact.

Answered: 125 Skipped: 45

Answer Choices (Most positive impact to less positive impact)	Weighed Average
Install dedicated bike facilities, such as bike lanes and separated bike lanes	63.7
Construct more multi-use trails	58.7
Make intersections safer for bicyclists	35.3
Make bicycling on local streets more comfortable by slowing traffic using speed humps, curb extensions and other roadway design elements.	22.3
Install more bicycle parking	20.3
Install more bicycle wayfinding signage	18.3
Install Share the Road signs on key streets	16.3
Decrease speed limits on certain roads	9.3

Q15 Which of the following policy and programs initiatives would make Northglenn a safer and friendlier place fo biking? Choose the 3 that would have the most positive impact.

Answered: 122 Skipped: 48

Answer Choices (Most positive impact to less positive impact)	Weighted Average
Develop bicycling-focused maps that show comfortable routes for bicycling to local destinations	54.0
Develop media campaign to educate drivers regarding bicyclist safety	31.0
Plan "Open streets" events where a street is temporarily closed to car traffic and open to bicycling and other activities	30.3
Increase law enforcement for motorists	28.0
Organize more group bicycling events	27.0
Develop programs for children/families to facilitate walking to school	26.7
Develop media campaign to educate bicyclists on safe bicycling habits	25.0
Increase law enforcement for bicyclists	20.7

Q16 Rank the following bicycle facilities in order of preference (1 being most desirable). See image below for example of facilities.

Answered: 127 Skipped: 43

Answer Choices (Most desirable to less desirable)	Weighted Average
Trails/Greenway	109.2
Separated Bike Lanes (protected bike lanes)	92
Bike Lanes	65.6
Bicycle Boulevard (quiet neighborhood streets)	64.8
On road (shared with traffic, no bike facilities)	29.4

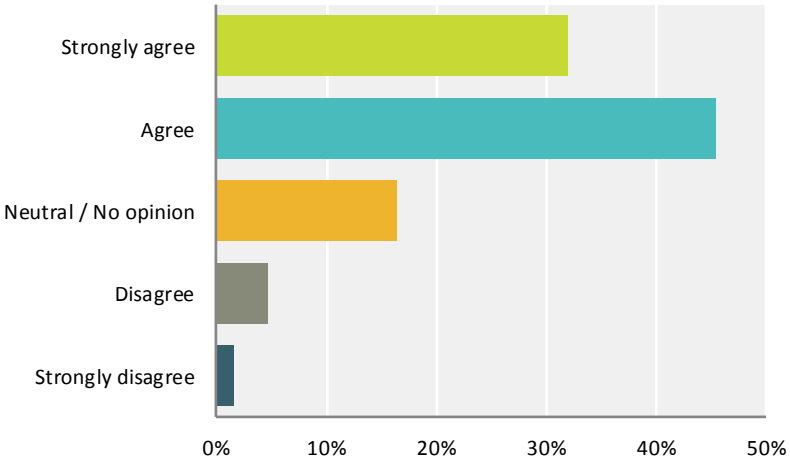
Q17 If you had $100 to spend on transportation improvements in your community, how would you spend your money? (You can allocate the funds to as many or as few purposes as you choose; the total should equal 100.)

Answered: 125 Skipped: 45

Answer Choices	Average Amount Allocated
Trails & Greenways (Improve existing or construct new, off-street trails where feasible)	$ 36.60
More Sidewalks (improve existing/widen sidewalks or construct new sidewalks to fill gaps)	$ 19.47
Make Intersections Safer for Pedestrians, Bicyclists, and Drivers	$ 16.40
On-street Bikeways (Construct new bike lanes)	$ 12.52
More Pedestrian Crosswalks	$ 7.02
Bicycle Parking	$ 4.55
Bicycle and Pedestrian Wayfinding	$ 3.76

Q18 What is your opinion of the following statement: Northglenn should prioritize identifying and allocating local transportation dollars to expand the pedestrian network (such as more sidewalks, crosswalks,etc.).

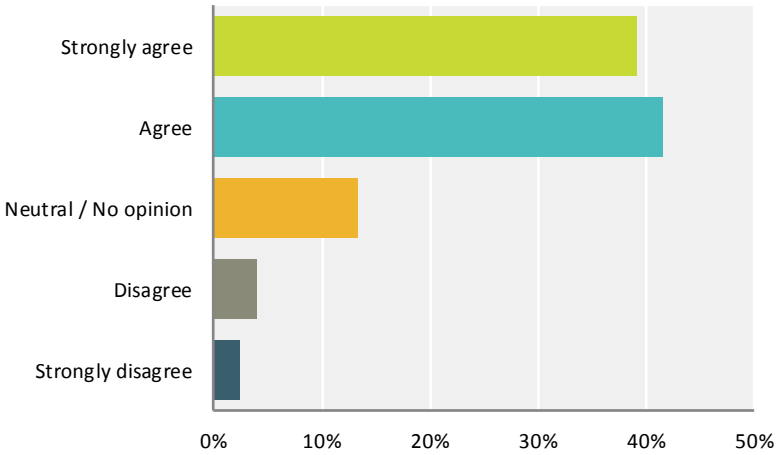
Answered: 128 Skipped: 42



	Strongly agree	Agree	Neutral / No opinion	Disagree	Strongly disagree	Total	Weighted Average
(no label)	**32.03%** 41	**45.31%** 58	**16.41%** 21	**4.69%** 6	**1.56%** 2	128	1.98

Q19 What is your opinion of the following statement: Northglenn should prioritize identifying and allocating local transportation dollars to expand the bikeway network (such as trails, marked bike lanes, etc.).

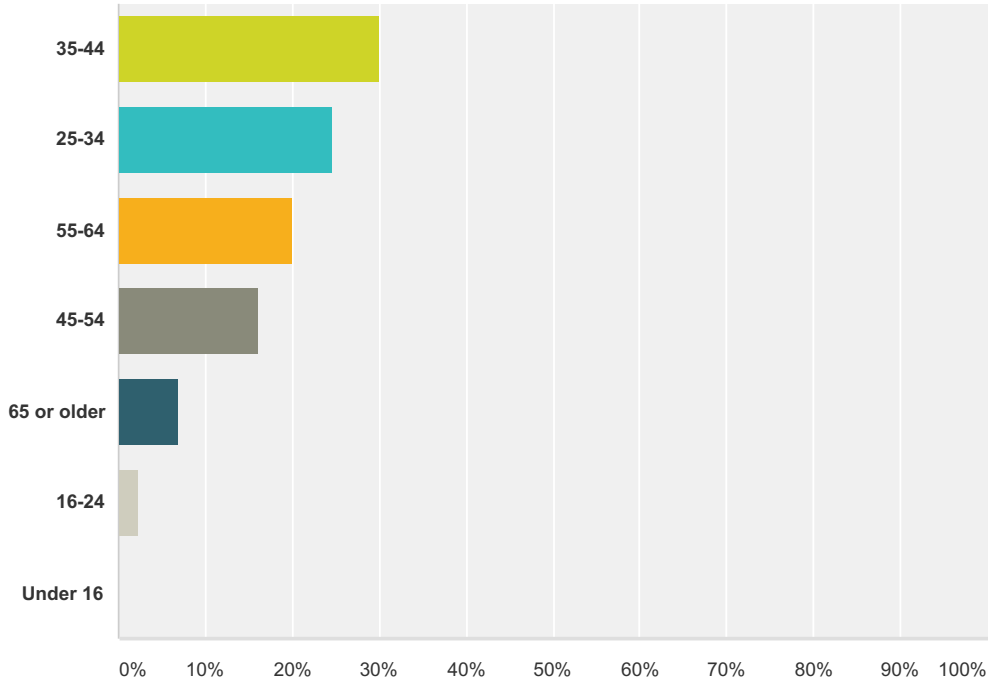
Answered: 128 Skipped: 42



	Strongly agree	Agree	Neutral / No opinion	Disagree	Strongly disagree	Total	Weighted Average
(no label)	**39.06%** 50	**41.41%** 53	**13.28%** 17	**3.91%** 5	**2.34%** 3	128	1.89

Q20 What is your age group?

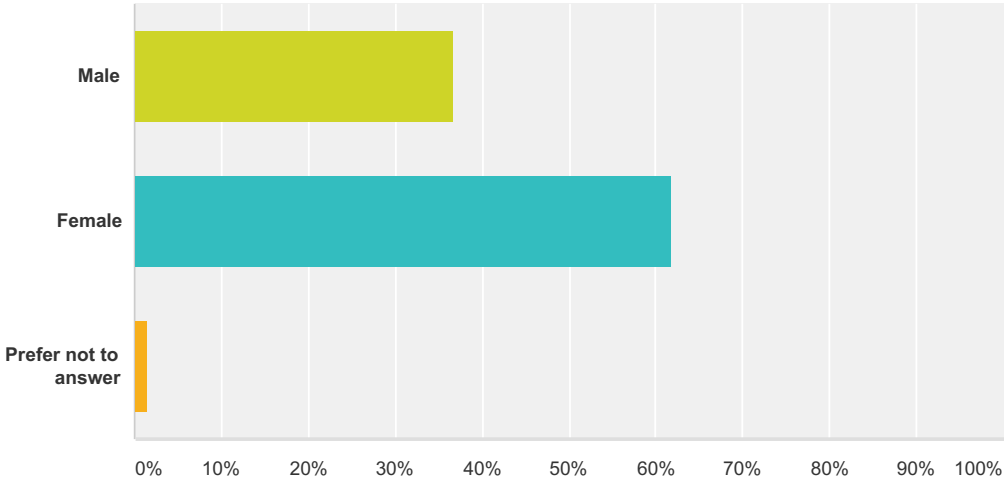
Answered: 130 Skipped: 40



Answer Choices	Responses	
35-44	**30.00%**	39
25-34	**24.62%**	32
55-64	**20.00%**	26
45-54	**16.15%**	21
65 or older	**6.92%**	9
16-24	**2.31%**	3
Under 16	**0.00%**	0
Total		**130**

Q21 With which gender do you identify?

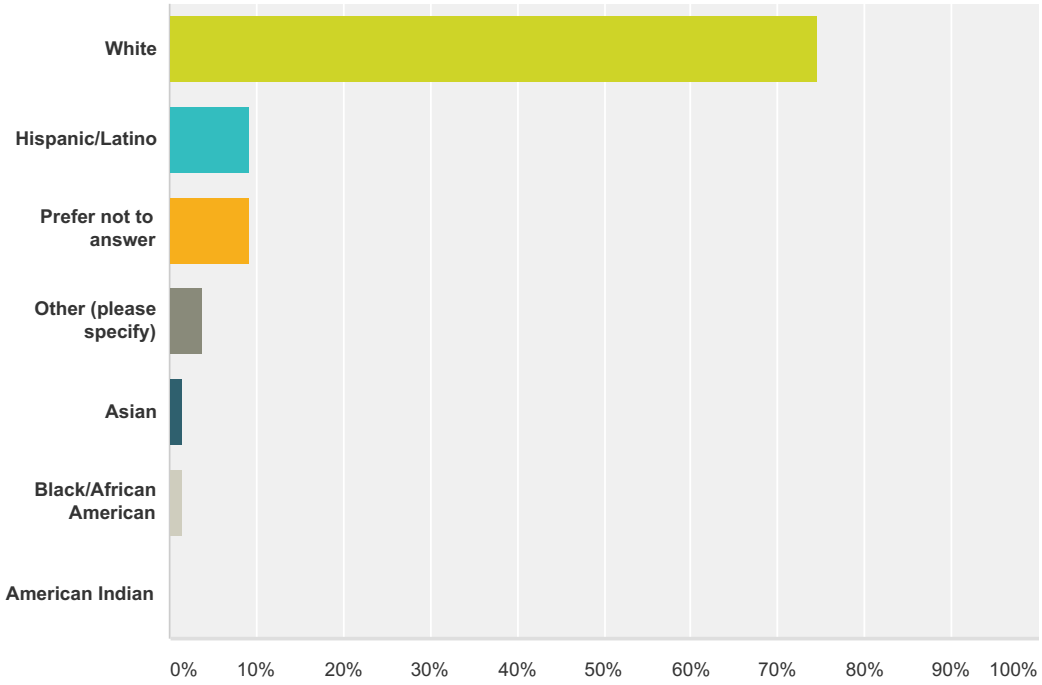
Answered: 131 Skipped: 39



Answer Choices	Responses	
Male	**36.64%**	48
Female	**61.83%**	81
Prefer not to answer	**1.53%**	2
Total		**131**

Q22 What is your ethnic background?

Answered: 130 Skipped: 40



Answer Choices	Responses	
White	**74.62%**	97
Hispanic/Latino	**9.23%**	12
Prefer not to answer	**9.23%**	12
Other (please specify)	**3.85%**	5
Asian	**1.54%**	2
Black/African American	**1.54%**	2
American Indian	**0.00%**	0
Total		**130**

Q23 Stay connected with the Plan at www.ConnectNorthglenn.com. If you would like to receive updates on the planning process, please provide your email address below (your survey answers will remain anonymous and your email will not be used for any purpose other than this plan).

Answered: 46 Skipped: 124

CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX D:

WAYFINDING PRINCIPLES AND BEST PRACTICES

APPENDIX D

NORTHGLENN WAYFINDING GUIDANCE
WAYFINDING BEST PRACTICES

CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN MASTER PLAN

alta PLANNING + DESIGN

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1. INTRODUCTION

This guide summarizes best practices and general signage guidelines for the development of Northglenn's non-motorized wayfinding network. Wayfinding, for the purposes of this plan, is defined as **a system of signs that provide navigational assistance to bicyclists and pedestrians, including information about destinations, travel distances, and other information about the system**. The wayfinding recommendations are based on findings from applicable research, existing precedents, and policies pertaining to wayfinding signage. These best practices will be a guide for the placement and design of a wayfinding system in Northglenn

This guide is divided into four sections. These sections provide an overview of best practices for non-motorized wayfinding, including wayfinding principles, types of signs, placement guidance, and destination selection.

2. WAYFINDING PRINCIPLES

The "legibility" of a place describes how easy it is to understand. Places are more legible when they are arranged so people can intuitively determine the location of destinations, identify routes, and recognize areas of different character. A wayfinding system helps to make places more legible by better enabling individuals to:

- Easily and successfully find their destination
- Understand where they are with respect to other key locations
- Orient themselves in an appropriate direction with little misunderstanding or stress
- Discover new places and services

The following guiding principles, based on best practices from around North America, will help create the most effective wayfinding systems.

1 : Connect Places

Wayfinding enables both residents and visitors to travel between destinations and to discover new destinations and services accessible to pedestrians and bicyclists. Wayfinding connects neighborhoods and provides navigational assistance to both local and regional destinations. Effective wayfinding is an extension to the bicycling and walking network and provides a seamless travel experience for non-motorized users.

The connectivity wayfinding enables goes beyond physical signage. Wayfinding signage elements can create a deeper connection to a place, cultivate a sense of pride by reflecting community values and identity, and support local economic development by encouraging residents and visitors to use services in Northglenn.

2 : Promote Active Travel

A wayfinding network should encourage increased rates of active transportation by creating a clear and attractive system that is easy to understand and navigate. The presence of wayfinding signs should help to communicate that walking and bicycling to many destinations is possible, helping to reduce physical barriers to using these modes for all types of trips.

An effective wayfinding system makes active transportation facilities more visible and helps to increase use of both on-street and off-street facilities. If existing facilities are underutilized, wayfinding improvements are a cost-effective way of increasing use.

3 : Maintain Motion

Bicycling and walking require physical effort, and frequent stopping and starting to check directions may lead to frustration and discouragement. Consistent, clear, and visible wayfinding elements allow people walking and bicycling to navigate while maintaining their state of motion. To help users maintain motion, wayfinding information also needs to be presented so that it can be quickly read and easily comprehended.

Together, these wayfinding principles are designed to create wayfinding systems that are legible and easy to navigate. These principles should guide the design, placement, and destination logic of all wayfinding in Northglenn.

4 : Be Predictable

Effective wayfinding networks are predictable. When information is predictable, patterns emerge, and users of the network will be able to rely on the system to provide information when they expect it. Predictability also helps users to understand new situations quickly, whether it be navigating a new intersection or travelling to a destination for the first time.

Users come to trust a predictable wayfinding network, making new journeys easier to attempt and complete. Every time a new trip is completed, users' confidence in the wayfinding network will be sustained or increased.

Predictability should relate to all aspects of wayfinding placement and design (i.e., sign materials, dimensions, colors, forms, and placement). Similarly, maps should employ consistent symbology, fonts, colors, and style. The system should be designed in accordance with local, state, and federal guidelines, ensuring that it can be funded through state and federal sources.

5 : Keep Information Simple

For a wayfinding network to be effective, information needs to be presented clearly and logically. The presentation of information needs to be balanced: too much information can be difficult to understand; too little and decision-making becomes impossible. The placement of signs and the information provided at each placement are also critical. To be successful, wayfinding information must be provided in advance of where major changes occur and confirmed when the maneuver is complete.

Wayfinding signage should be accessible and be designed to be comprehensible by a wide range of users, including people of all ages and ability levels. Special consideration should be taken for those without high educational attainment, English language proficiency, or spatial reasoning skills. In areas with high rates of users with English as a second language, the wayfinding should use text and symbols that will be understood by non-English speakers. Designers should minimize the use of bilingual text or separate-language signs, as including these elements can make signs cluttered and reduce overall legibility.

It is important to provide information in manageable amounts. Too much information can be difficult to understand; too little and decision-making becomes impossible. Information should be provided in advance of where major changes in direction are required, repeated as necessary, and confirmed when the maneuver is complete.

3. WAYFINDING NAVIGATIONAL ELEMENTS

The goal of wayfinding signage is to enhance the user's experience. This section describes the fundamental navigational elements that are recommended to increase legibility along Northglenn's on- and off-street network. This section also describes enhanced wayfinding tools that can be integrated into the wayfinding system to provide additional clarity and opportunities to create custom components reflecting the character of Northglenn. Both the fundamental and enhanced elements described apply to both the on-street and off-street active transportation and recreation network. Wayfinding elements reviewed in this section include:

Fundamental Navigational Elements

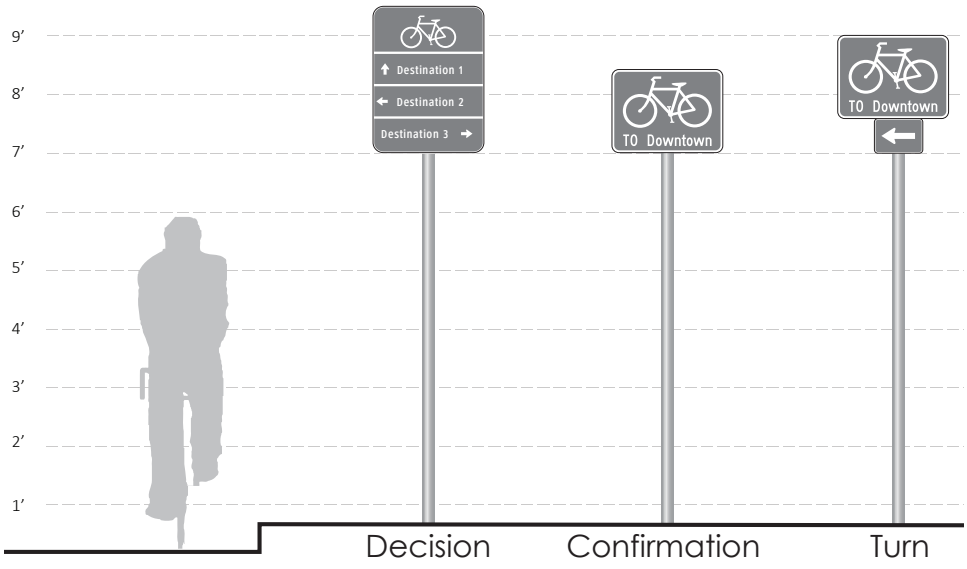
- Decision sign
- Confirmation sign
- Turn sign

Enhanced Navigational Elements

- Pavement markings
- Mile markers
- Map kiosks

3.1 FUNDAMENTAL NAVIGATIONAL ELEMENTS

The fundamental family of signs that provide navigational information consists of decision, confirmation, and turn signs. The function, content, and placement of each are described below.



Fundamental on-street wayfinding tools

The MUTCD provides guidelines for the design of bicycle and pedestrian wayfinding. Decision signs clarify route options when many are available. Distance measurements and approximate travel time calculations can also be included on decision signs.

Confirmation signs reassure users that they are on the correct route. White print on a dark background provides good contrast at night.

3.1.1 DECISION SIGN

Function and content: Decision signs clarify route options when many are available. Signs typically consist of a system brandmark and space for up to three destinations. Decision signs may also include the specific route or path name. A minimum font height of 6 inches per destination should be used, and font width may vary according to destination length. Some agencies explicitly allow adding distance in miles and/or time (10 miles per hour/6 minute per mile travel speed for bicyclists; 3 miles per hour/20 minutes per mile for pedestrians).

Per the Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Devices* (MUTCD) and *Standard Highway Signs*, the standard size for a sign that lists destinations in three lines (see example to the left) is 18 inches high by 30 inches wide. However, many municipalities use a vertical format sign that measures 24 inches wide by 30 or 36 inches tall. This is accomplished by omitting the bicycle symbol from each separate line and instead having a single symbol at the top of the sign. Generally, providing 6 inches of vertical space per destination line allows for the 2 inch minimum text height. Sign width is not standardized by the MUTCD. These dimensions apply to both on- and off-street facilities.

Placement: Decision signs should be placed before decision making points or intersections. Sufficient distance prior to the intersection (based on trail design speed, number of destinations, and other sign placement factors) should be provided to allow for safe recognition and response to information provided. Care should be taken so that the turns or options that the sign refers to are obvious. Decision signs should not be placed near side or access paths that could be confused with the primary route.

Clearance: The nearest edge of any sign should be placed a minimum of 24 inches from face of curb or edge of pavement for both on- and off-street facilities. Mounting height should be a minimum of 7 feet from the bottom of the sign to finish grade for on-street signs and a minimum of 4 feet for signs on paths.

3.1.2 CONFIRMATION SIGN

Function and Content: Confirmation signs, placed after a turn movement or intersection, reassure users that they are on the correct route. System brandmark and route or pathway name may be included. A minimum size of 24 inches wide by 18 inches high should be used for bike route signs whether on-street or off-street.

Placement: Signs should be placed 50 to 100 feet after decision points. Confirmation signs need not occur after every intersection. They should be prioritized at locations where a designated route is not linear as well as after complex intersections. Complex intersections include those having more than four approaches, non-right angle turns, roundabouts, or in-direct routing.

Clearance: The nearest edge of any sign should be placed a minimum of 24 inches from face of curb or edge of pavement for both on- and off-street facilities. Mounting height should be a minimum of 7 feet from the bottom of the sign to finish grade for on-street signs and a minimum of 4 feet for signs on paths.

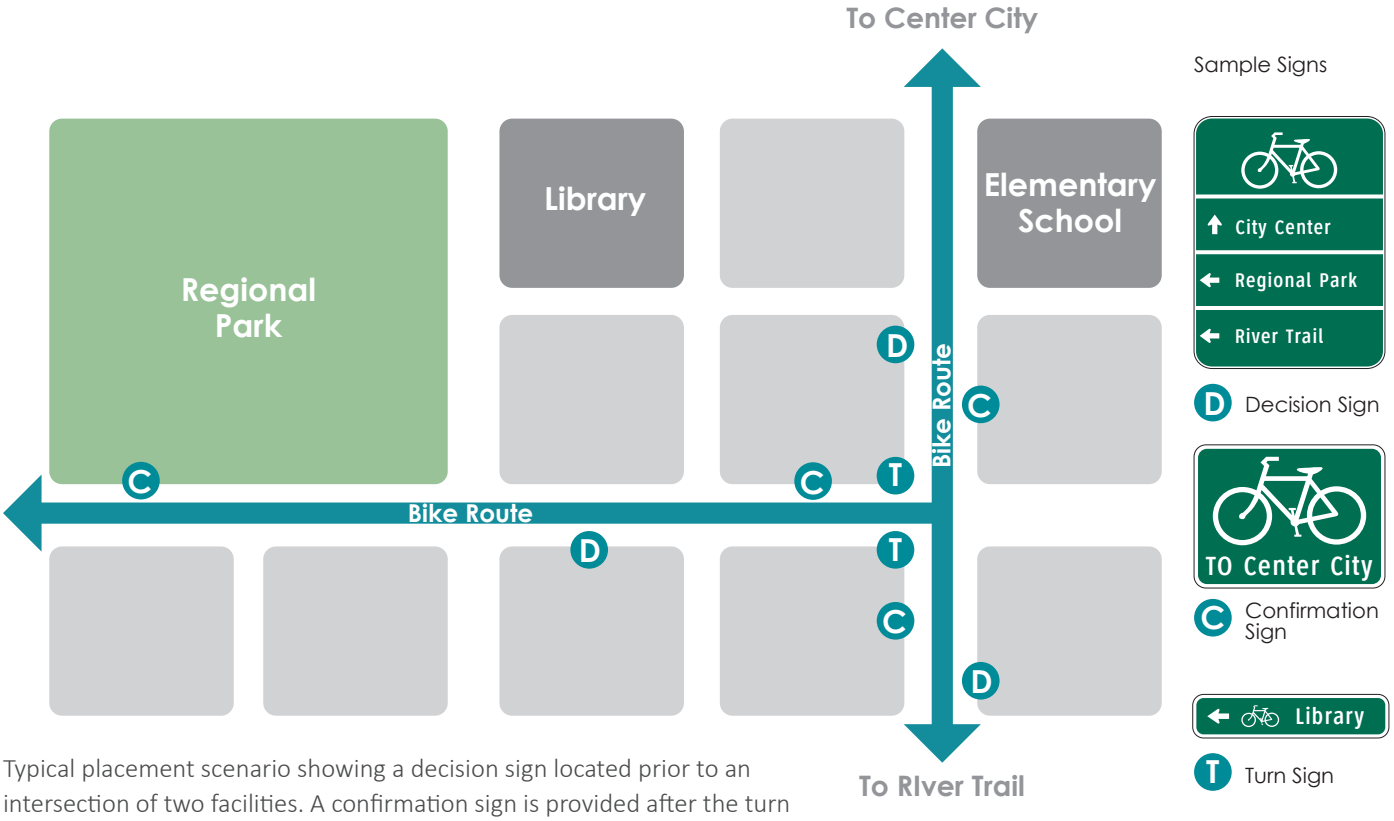
3.1.3 TURN SIGN

Function and Content: Turn signs clarify a specific route at changes in direction when only one route option is available. These signs may include a system brandmark, route or pathway name, and directional arrow. Standard D1-1 series signs may be used to indicate turns. Turn signs use height and width considerations similar to decision signs. Standard turn arrow signs (M5 and M6 series) may also be used in conjunction with bike route signs to clarify turn movements.

Placement: Placed at turns prior to the turning action to provide users advance notice of a change in direction. Turn signs may be used in conjunction with a decision sign at complex intersections warranting additional guidance.

Clearance: The nearest edge of any sign should be placed a minimum of 24 inches from face of curb or edge of pavement for both on- and off-street facilities. Mounting height should be a minimum of 7 feet from the bottom of the sign to finish grade for on-street signs and a minimum of 4 feet for signs on paths.

Turn signs clarify a specific route at changes in direction when only one route option is available. Consistency in sign types, letter heights, directional arrows, and destination name lengths contribute to an effective wayfinding system.



Typical placement scenario showing a decision sign located prior to an intersection of two facilities. A confirmation sign is provided after the turn movement as well as periodically along the route for reassurance.

Shared lane markings have been applied to Grant St to provide wayfinding guidance for bicyclists.

3.2 ENHANCED NAVIGATIONAL ELEMENTS

3.2.1 PAVEMENT MARKINGS

Directional pavement markings indicate confirmation of user presence on a designated route and where users should change direction. Especially in urban settings, pavement markings can often be more visible and can help supplement or reinforce signs.

On-Street Markings

The following images show different types of pavement markings used for wayfinding purposes. While the shared lane marking (left) is currently the only FHWA approved pavement marking, cities have experimented with the other options.

In Berkeley, CA, and Minneapolis, MN, some bicycle boulevards have large “Bicycle Boulevard” stencils that take up nearly the entire width of one travel lane.

In some places in the US, the chevrons on the top of the MUTCD-standard bicycle symbol are used to indicate the direction of intended travel (seen in second photo from left in the four-photo matrix above). Although this practice is not approved by the FHWA or eligible for federal funding, many local transportation engineers are confident that the benefits of the turned, directional chevrons outweigh the risks. Portland, OR (above-referenced photo), installs standard shared lane markings with federal funds and then makes modifications later with local funds to add the directional wayfinding component.

Pavement markings can also be applied to off-street routes, and can include custom branding and mileage information, such as the markings used for the trail system in the Research Triangle Park in Raleigh/Durham, NC. .

Off-Street Markings

Some pavement markings, including off-street shared use path markings, can give an identity to the route and include directional and trip information, including distances and/or times. While such markings are not included as traffic control devices within the MUTCD, numerous communities have implemented off-street markings using thermoplastic or other materials. The installation of thermoplastic on concrete trails requires the use of a binder. Other marking materials, such as an epoxy paint, may be more appropriate for this trail surface type.

3.2.2 MILE MARKERS

Mile markers aid pathway users with measuring distance traveled. Furthermore, mile markers provide pathway managers and emergency response personnel points of reference to identify field issues such as maintenance needs or locations of emergency events. System brandmark, path name, and distance information in miles may be included as well as jurisdiction identification.

Mile markers should be placed every 1/4 to 1/2 mile along a pathway network. Point zero should begin at the southernmost and/or westernmost terminus points of a pathway. Mile numbering is often reset at zero as a pathway crosses a jurisdictional boundary, but regionally-significant trails may choose continuous numbering.

Although it is ideal to place mile markers on the righthand side of the path facing bicycle traffic, they may also be installed on one side of a pathway, on a single post, front and back.

Mile marker sign.

3.2.3 MAP KIOSKS

Kiosks with area- and/or citywide orientation maps can provide helpful navigational information, especially where users may be stopping long enough to digest more information (i.e., transit stations or stops, busy intersections, trailheads). The use of icons and high-contrast colors makes maps understandable to a wide audience of different ages and abilities.

Adding circles that indicate walk and bike times provides encouragement to explore surrounding areas. Additionally, orienting signs with respect to the audience's view (or, a heads up orientation) is considered by wayfinding practitioners to be more intuitive than those with north at the top. High-contrast graphics and the use of color coded areas or districts help a wider audience comprehend the map's contents and their surroundings.

Kiosks with maps are also a useful resource for trail users. Again the use of high contrast and simple graphics and icons enhances legibility for a broad spectrum of users. Kiosks should contain information on trail or path rules and regulations, including allowed uses. Emergency contact information is also typically present. Interpretive or educational information may also be integrated. Per the Americans with Disabilities Act (ADA) standards, trailhead facilities built with federal funds shall include the following information:

1. Length of the trail or trail segment
2. Surface type
3. Typical and minimum tread width
4. Typical and maximum running slope
5. Typical and maximum cross slope

Orientation map.

4. WAYFINDING SIGN PLACEMENT GUIDANCE

The *Guide for the Development of Bicycle Facilities* by the American Association of State Highway Transportation Officials (AASHTO) provides information on the physical infrastructure needed to support bicycling facilities. Most of this guidance applies to off-street, shared-use paths as well. The AASHTO Guide largely defers to Part 9 of the MUTCD (discussed in the following section) for basic guidelines related to the design of wayfinding systems. Additional information provided by AASHTO regarding wayfinding is as follows:

- Many communities find that a wayfinding system as a component of an active transportation network enhances other encouragement efforts, because it provides a visible invitation to new users, while also encouraging current or experienced users to explore new destinations.
- Wayfinding signs should supplement other infrastructure improvements so that conditions are favorable, as signs alone do not improve safety or rider comfort.
- Guide signs may be used to designate continuous routes that may be composed of a variety of facility types and settings.
- Wayfinding guidance may be used to provide connectivity between two or more major facilities, such as a street with bike lanes and/or sidewalks and a shared-use path.
- Wayfinding may be used to provide guidance and continuity in a gap between existing sections of a facility, such as a bike lane or shared-use path.
- Road/path name signs should be placed at all path-roadway crossings to help users track their locations.
- Reference location signs (mile markers) assist path users in estimating their progress, provide a means for identifying the location of emergency incidents, and are beneficial during maintenance activities.
- On a shared-use path, obstacles, including signs, shall be placed no closer than 24 inches from the near edge of the travel way and no more than 6 feet away. For pole-mounted signs, the lowest edge of the sign shall be 4 feet above the existing ground plane.

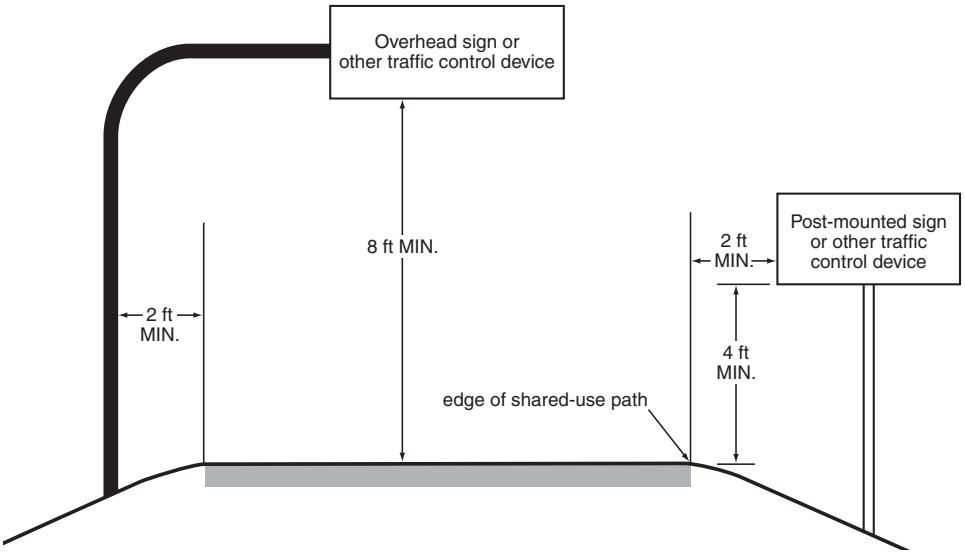
4.1 ACCESSIBILITY STANDARDS

As wayfinding systems often relate to accessible routes or pedestrian circulation, it is important to consider technical guidance from the ADA in order to implement wayfinding signs and other elements that do not impede travel or create unsafe situations for pedestrians, bicyclists, and/or those with disabilities. The Architectural and Transportation Barriers Compliance Board and the AASHTO *Guide for the Development of Bicycle Facilities* also provide guidance for safe and accessible design for the built environment.

The following are standards that should be considered when designing and placing wayfinding signs.

4.1.1 VERTICAL CLEARANCE

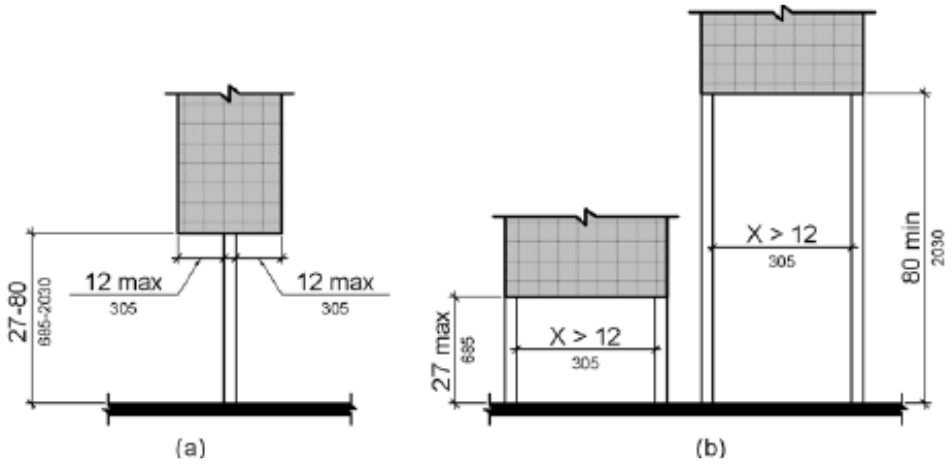
Vertical clearance shall be 96 inches high maximum (when overhanging the path), or 48 inches minimum from the grade of the path to the bottom of the sign and 24 inches from the edge of the path tread to the edge of the sign when the sign is mounted adjacent to the trail.



Minimum clearances on shared-use paths (AASHTO)

4.1.2 POST-MOUNTED OBJECTS

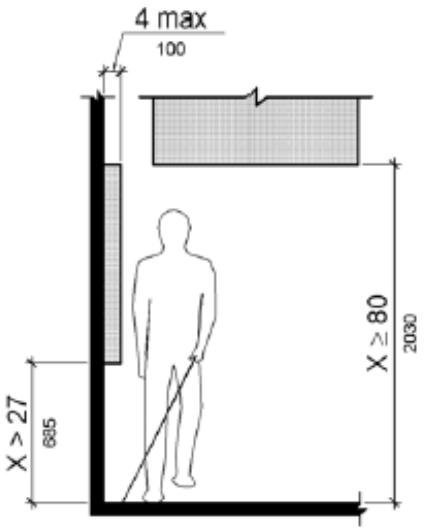
Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches, the lowest edge of such sign or obstruction shall be 27 inches minimum or 80 inches maximum above the finish floor or ground.



(AASHTO)

4.1.3 PROTRUDING OBJECTS

Objects with leading edges more than 27 inches and not more than 80 inches above the finish floor or ground shall protrude 4 inches maximum horizontally into the circulation path.



(AASHTO)

4.1.4 REQUIRED CLEAR WIDTH

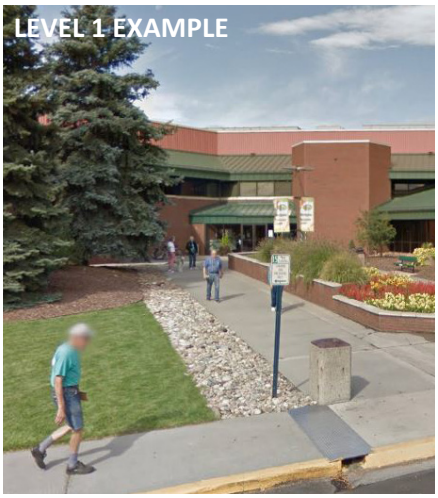
Protruding objects may not, in any case, reduce the clear width required for accessible routes. Generally this requirement is met by maintaining 4 feet minimum clear width for people maneuvering mobility devices. This requirement applies to sidewalks and other pedestrian circulation paths.

4.1.5 SHARED USE PATHS

Accessibility standards for shared-use paths are currently being developed. Proposed standards address post-mounted objects as follows:

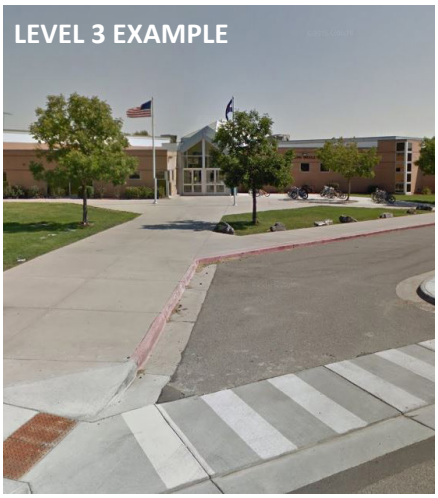
Where objects are mounted on free-standing posts or pylons and the objects are 27 inches minimum and 80 inches maximum above the finish surface, the objects shall overhang pedestrian circulation paths 4 inches maximum measured horizontally from the post or pylon base. The base dimension shall be a minimum of 2.5 inches thick. Where objects are mounted between posts or pylons and the clear distance between the posts or pylons is greater than one foot, the lowest edge of the object shall be 27 inches maximum or 80 inches minimum above the finished surface.

DESTINATION EXAMPLES



Northglenn Civic Campus is an example of a Level 1 Destination. (Google Maps)

Wagon Road Park N' Ride is an example of a Level 2 Destination.



Northglenn Middle School is an example of a Level 3 Destination. (Google Maps)

5. DESTINATION SELECTION AND PROGRAMMING

Following the principle to "connect places," the following describes an approach for selecting potential destinations to which people walking and bicycling may want to travel. Wayfinding signs typically only allow for a maximum of three destinations per sign. Thus, a consistent approach to selecting destinations to be included on wayfinding elements is necessary, given the multitude of potential destinations possible. Signs should follow the same approach throughout Northglenn so that the system is clear and predictable. Destinations and their names should be referred to consistently on all relevant wayfinding signs.

5.1 DESTINATION SELECTION

Potential destinations for inclusion on signs are categorized within three levels. Level 1 destinations should receive first priority on wayfinding signs, followed by Level 2. Level 3 destinations should only be included when other destinations are not present to fill available slots on a sign. All destinations to be included on the signs should be open and accessible to the public.

LEVEL 1 – DISTRICTS AND NEIGHBORHOODS

Level 1 destinations provide specific navigational information by directing users to recognizable districts and neighborhoods. These may be city centers; historic, commercial, cultural, or educational districts; or neighborhoods with a distinct and recognizable name and character. Emphasis should be placed on districts providing a mix of services. Neighborhoods not offering services or attractions need not be included. Level 1 destinations should be included on signs up to 3-4 miles away.

LEVEL 2 – LANDMARKS

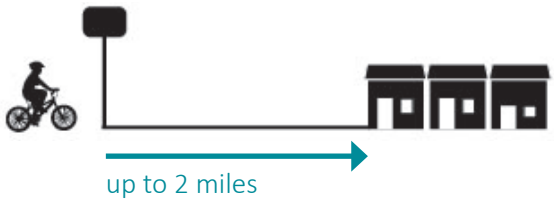
Level 2 destinations are specific landmarks or major attractions which generate a high volume of visitors. Landmarks include transit stations, major tourist venues, regional parks, open spaces, and post-secondary educational institutions. Level 2 destinations should be signed up to 2 miles away.

LEVEL 3 – LOCAL DESTINATIONS

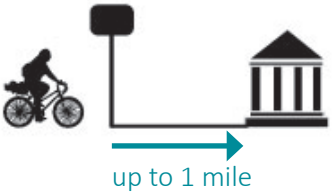
Level 3 destinations are local destinations such as civic buildings, parks, high schools, shopping centers, and healthcare facilities. They typically occur on signs in low-density areas where few other destinations are present or along pathways not connecting higher priority (Level 1 and 2) destinations. Level 3 destinations may be signed up to 1 mile away.

LEVEL 1
- City Centers
- Districts
- Neighborhoods

LEVEL 2
- Transit Stations
- Tourist Venues
- Regional Parks
- Open Space
- Universities



LEVEL 3
- Local Destinations
- Parks
- Schools
- Shopping Centers
- Healthcare



5.2 SIGNING DISTANCES

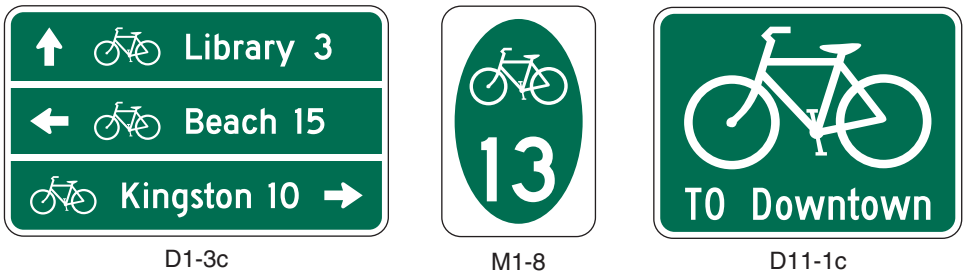
Signing distances suggest the maximum distance that destinations should appear on directional signs. This process ensures that information is spread along the journey in manageable amounts according to users' immediate needs.

Distances may be measured either to a destination boundary or center, as long as the approach is consistent throughout the region. Districts (Level 1 destinations) should be measured to their centers. Level 2 and 3 destinations are typically specific addresses, and, thus, distances should be measured to the main entrance of the specific location. If a Level 2 or 3 destination is large or has several access points, distance should be measured to the point at which the bicyclist or pedestrian will most likely arrive.

5.3 DESTINATION ORDER

5.3.1 NATIONAL GUIDANCE

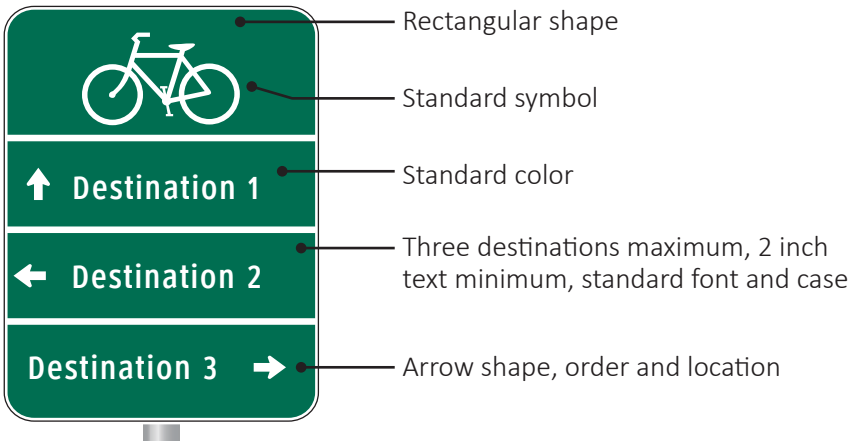
The MUTCD is a document issued by the FHWA of the United States Department of Transportation. The MUTCD specifies the standard for all traffic control devices (including wayfinding signs and pavement markings) installed on any street, highway, bikeway, or private road open to public travel. The MUTCD was established in order to achieve uniformity and consistency in traffic control devices so that information would be readily recognized and understood by travelers. Both on-street and off-street bicycle facilities are required to follow the standards within the MUTCD.



Standard MUTCD-compliant destination sign, bicycle route sign, and bicycle guide sign

Per the MUTCD, signs should be designed so that:

- Size, shape, color, composition, lighting or retro-reflection, and contrast are combined to draw attention to the sign; simplicity of message combine to produce a clear meaning.
- Legibility and size combine with placement to permit adequate time for response.
- Uniformity, size, legibility, and reasonableness of the message combine to command respect.



Standard MUTCD-compliant directional or decision sign

The MUTCD also recommends the arrangement and amount of text, also referred to as legend, on each section of each sign:

- Guide signs should be limited to no more than three lines of destinations, which include place names, route numbers, street names, and cardinal directions.
- A straight-ahead location should always be placed in the top slot followed by the destination to the left and then the right. If two destinations occur in the same direction, the closer destination should be listed first followed by the farther destination.
- Arrows shall be depicted as shown above for glance recognition, meaning straight and left arrows are to be located to the left of the destination name, while an arrow indicating a destination to the right shall be placed to the right of the destination name. The approved arrow style must be used.
- Nineteen characters (including spaces) in title case should be considered a maximum length for a single destination title. Ten to 14 characters (including spaces) in title case should be considered an *ideal* length for a single destination title.
- In situations where two destinations of equal significance and distance may be properly designated and the two destinations cannot appear on the same sign, the two names may be alternated on successive signs.
- Approved fonts include the Federal Series (series B, C, or D), also known as Highway Gothic. The interim approval for use of the Clearview font was granted in 2004 but was rescinded in January 2016.
- A contrast level of 70 percent needs to be achieved between foreground (text and graphics) and background.

6. REFERENCES

6.1 ABBREVIATIONS

When placing destination names on signs, the use of abbreviations should be kept to a minimum whenever possible. When insufficient space is available for full wording, abbreviations may be used. Acceptable abbreviations according to the MUTCD are included below. Unless necessary to avoid confusion, periods, commas, apostrophes, question marks, ampersands, and other punctuation marks or characters that are not letters or numerals should not be used in any abbreviation.

Word Message	Abbreviation	Word Message	Abbreviation
Alternate	ALT	Miles Per Hour	MPH
Avenue	AVE	Minute(s)	MIN
Bicycle	BIKE	Mount	MT
Boulevard	BLVD	Mountain	MTN
Bridge	BR	National	NATL
Center (as part of a place name)	CTR	North	N
Circle	CIR	Parkway	PKWY
Court	CT	Pedestrian	PED
Crossing (other than highway)	X-ING	Place	PL
Drive	DR	Road	RD
East	E	South	S
Hospital	HOSP	Street	ST
Information	INFO	Telephone	PHONE
Internation-al	INTL	Terrace	TER
Junction / Intersection	JCT	Trail	TR
Mile(s)	MI	West	W

6.2 ICONS & SYMBOLS

Icons and symbols can be welcome additions to wayfinding signage design toolkit because they help to communicate information simply and expand comprehension beyond those with English language proficiency. Where proficiency is low, icons and symbols can substitute for words or concepts that are hard to explain or translate, such as trailhead, transit, or school.

Universal symbology and iconography that have been developed by the AIGA (telephone, first aid, toilets), National Park Service (campsite, toilet, scenic view, airport, picnic area), and others (hanidcap, passenger rail, light rail) are familiar to most people and translate across most languages and cultures.

Use of symbols and icons on wayfinding signage, especially within names of destinations, can save space and improve legibility and comprehension.

6.3 REFERENCES

Accessibility Standards. US Access Board, 2012. http://www.accessboard.gov/guidelines-and-standards

"Assessment of the Impact of the Indianapolis Cultural Trail: A Legacy of Gene and Marilyn Glick." Indiana University Public Policy Institute, March, 2015. http://policyinstitute.iu.edu/uploads/PublicationFiles/15-C02%20CulturalTrail%20Assessment.pdf

"Design Guidelines for Bicycle Wayfinding." City of Oakland, CA, 2009.

Graphic Identity & Sign Guidelines Manual. Allegheny Trail Alliance and Trail Town Program, August 31, 2008. http://www.atatrail.org/docs/GAPGuidelines.pdf

Guide for the Development of Bicycle Facilities, Fourth Edition. American Association of State Highway Transportation Officials, 2012.

Manual on Uniform Traffic Control Devices. Federal Highway Administration, 2009. http://mutcd.fhwa.dot.gov/index.htm

Standard Highway Signs. Federal Highway Administration, 2012.

"Wayfinding Signs for Shared-Use Paths." National Committee on Uniform Traffic Control Devices, Spring 2014. http://www.ncutcdbtc.org/sponsors.html

CONNECT NORTHGLENN

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BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX E:

BICYCLE PARKING

Appendix E: Bicycle Parking

People will be more likely to bicycle if safe, accessible, and convenient bicycle parking is provided. Improving short term bike parking, including covered parking, and long-term parking are integral to supporting the growth of Northglenn's bicycle mode share. Additionally, providing convenient parking can reduce instances of bicycles being parked to objects in the public right of way, which can be hazardous to pedestrians.

This appendix summarizes opportunities to improve bicycle parking practices in Northglenn, based upon best practices that have been established in cities across the United States. Key recommendations include developing a Bicycle Parking Code and a Bicycle Parking Program to standardize the type and quantities of bike parking available to the public.

BICYCLE PARKING: OPPORTUNITIES FOR IMPROVEMENT

The review of existing bike parking conditions in the City of Northglenn summarized in Section 2.7 of the Existing Conditions Chapter, revealed issues with current bike parking in the community. These issues include:

- There is not an adopted standard rack type, resulting in a mix of racks in the community, the majority of which (53 percent) are difficult to use and are not APBP-approved.
- There is no requirement for new commercial or residential development or redevelopment projects to include bicycle parking as a condition of approval.
- Only eight of 13 Northglenn schools are equipped with bicycle parking.

Solutions are available to overcome these issues, which have been successfully implemented in cities across the country. This section describes these solutions, and how they can be developed in Northglenn. The recommended solutions include:

- **Developing a bike parking code** as part of a future Zoning Code update to standardize rack type and placement practices, and ensure bike parking is installed with new development.
- **Developing a bike parking program** that allows the community to request the placement of racks on public lands, and property owners to request racks on their private land (otherwise, these racks may never be installed in areas where they are needed, such as auto-oriented 'strip-mall' developments).

BICYCLE PARKING: OPPORTUNITIES FOR IMPROVEMENT

The bike parking code developed by Northglenn should be included in a future Zoning Code update and incorporate best practices that have been implemented by bike friendly cities across the country. The code should specify acceptable rack placement practices and rack types. Placement practices should conform to those described in the Association of Pedestrian and Bicycle Professionals (APBP) *Essentials of Bike Parking* (2015). To be consistent with best practices, the code should include a tiered bike parking design standard, ensuring reliable and convenient bike parking is provided in different settings, including both short-term and long-term bicycle parking. The recommended tiered approach to bike parking is included on page 5-15.

The code should also require short-and long-term bike parking for new construction and redevelopment. Minimum bicycle parking requirements hold developers accountable to provide necessary end-of-trip facilities for specific land uses.

The APBP *Bicycle Parking Guidelines* (2nd Edition, 2010) should serve as the primary reference for the development of bike parking minimums. Specifically, the code should be based upon recommendations included in pages 3-1 to 3-7 of the *Guidelines*. This section of the *Guidelines* provides minimums for urbanized areas, which would be relevant to the Northglenn Civic Center Campus redevelopment, where parking should be concentrated (see pages 3-5 to 3-7), as well as lower density areas (see pages 3-2 to 3-4). Both sections should be reviewed when developing the code so that appropriate minimums are established based upon density and other land-use characteristics. Table E.1 identifies other criteria that should be considered in the development of the bike parking code.

Table E.1: Considerations for Bike Parking

#	Considerations
1	**Codify City Standard Rack Type.** Codify the inverted U rack as the City's official rack type, and require that all racks installed via the code comply with this rack typology. Art racks should require special review by the planning and engineering department for approval before installation.
2	**Provide minimum bicycle parking requirements for nonresidential uses for short- and long-term use.** Institute bike parking minimums (for both short term and long term parking) based upon APBP guidance included in Bicycle Parking Guidelines, 2nd Edition, 2010 (see pages 3-5 to 3-7 of guidelines). The codes requirements should match the land-use categories already present for vehicle parking requirements. Consider requiring Indoor/Garaged bicycle parking for all new buildings that require covered vehicle parking, at or above, the minimum bicycle parking requirements, especially in in the Civic Center Campus. Prohibit property owners to forgo minimum bicycle parking requirements for non-residential uses. Differentiate and clarify short- and long-term bicycle parking requirements and add information about bicycle rack type, design, placement, security, wayfinding, and access. The city can set its own minimums that may reduce or exceed those suggested by industry resources. Reference APBP *Essentials of Bicycle Parking* (2015) for guidance.
3	**Create bicycle parking requirement for multifamily residential uses.** Based upon ABBP guidance included in Bicycle Parking Guidelines, 2nd Edition, 2010 (see pages 3-5 to 3-7), the new requirement should specify parking minimums for multi-family residential development. A minimum number of units necessary to require parking should be specified, as single family residences (with or without garages) typically do not have bike parking requirements. A mix of bicycle parking types that accommodate a variety of family-friendly bicycles for all ages and abilities and wayfinding signage to locate it should be required.
4	**Allow provision of long-term bicycle parking and/or additional short-term racks to substitute for a portion of required automobile parking.**
5	**Reference illustrated design guidelines for developers and building managers** to facilitate the installation of well-designed sheltered bicycle parking, secure bicycle parking, and wayfinding signage. Illustrations to be referenced are included in APBP Essentials of Bicycle Parking (2015).
6	**Include a provision for 24/7 bicycle parking access** in requirements for long-term bicycle parking located in parking garages.
7	**Support self-service bicycle repair facilities** as part of long-term bicycle parking.

DEVELOPING A BIKE PARKING PROGRAM

While the bike parking code will help to ensure that bike parking is installed with new development and redevelopment, it will not lead to the installation of bike parking near properties that are not seeking construction permits. Demand for parking exists throughout Northglenn, and to ensure that parking is distributed throughout the community, the City of Northglenn should support the development of a bike parking program. This program should be focused on two objectives:

- Providing bike parking at the Civic Center Campus as it redevelops.
- Providing more bike parking throughout Northglenn.

The Northglenn bike parking program should become the primary method for installing public bicycle parking. This program will ensure that bike racks are installed in the public right-of-way to serve commercial buildings, schools, and multi-family residential developments and on private land if racks are requested by property owners. The program should be focused on identifying where there are gaps in the availability of bike parking, and prioritize those gaps. Racks installed through the program should

adhere to the same bike rack specifications and installation standards as identified in the proposed bike parking code.

The development of the bike parking program should be a partnership between the City of Northglenn, Adams County, and other organizations. For instance, the Downtown bike parking program could be run in partnership between the City of Northglenn and the Metro North Chamber of Commerce. Such partnerships have been successful in installing bike parking in other U.S. cities. The City of Northglenn and Adams County could consider adopting this policy as well, or alternatively, maintain the parking in coordination with other organizations. Other factors for consideration in the development of the program are outlined in Table E.2.

Table E.2: Bike Parking Spot Improvement Program Considerations

#	Actions
1	**Institute a Request-A-Rack Program.** Develop two programs, one focused on the Civic Center Campus and the other focused on areas outside of the Civic Center Campus, where local businesses and/or the public can make a request for a rack to be installed within the public right-of-way or on private property if requested by the property owner (for racks placed on private property, the program should fund the rack and installation, but once installed, the rack should become the responsibility of the property owner/s). Identify partners to help develop and run each program. Make requesting a rack easy, by providing a web portal where racks can be requested. Require a minimum response time to respond to rack requests. Include language that acknowledges who is responsible for the installation and maintenance of the racks, such as the City of Northglenn, Adams County, or another organization/agency. The program should also address rack replacement, maintenance, and abandoned bicycles.
2	**Prioritize the installation of bicycle racks and on-street bicycle corrals in high-demand locations.** High-demand locations include, but are not limited to, neighborhood business districts, community centers, libraries, employment centers, parks, and schools. Determine when bicycle parking should be sheltered bicycle parking, such as at schools where students/staff will park their bicycles for extended periods of time. Ensure installation is distributed equitably throughout the city.
3	Create a process that allows the city to use curb space or on-street parking spaces for on-street bicycle corrals. Work with the chamber of commerce and neighborhood business districts to identify locations that will replace on-street parking with on-street bicycle corrals. Install on-street bicycle corrals at strategic intersection locations where vehicle parking is not allowed, or where supported by businesses if vehicle parking is to be removed. Smaller corrals can sometimes be provided without affecting parking by using space that is unavailable for parking, such as sight distance set backs and curb line transitions or at bulb-outs.
4	**Install only the standard rack type identified in the proposed City Bike Parking Code** to develop a graphic identity and citywide branding for Northglenn's bicycle parking. Installation of art racks would require special review by the planning and engineering departments.
5	**Create and Maintain a Bicycle Parking Inventory.** Maintain and continually update a digital inventory of public bicycle parking locations by the City's Planning Division. Integrate bicycle parking data into city-sponsored mapping and digital applications that depict the bicycle network as it grows.
6	**Establish Annual Program Budget.** A budget line should be added to the City budget to fund the programming and implementation of the Bike Parking Program.

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MASTER PLAN

APPENDIX F:

COUNTS SUMMARY

Appendix F: Bicycle and Pedestrian Counts

COUNTS SUMMARY

On May 17, 2017 between 7 AM and 9 AM, All Traffic Data Services, Inc. conducted morning peak-hour bicycle and pedestrian counts, as defined by the FHWA Traffic Monitoring Guide, at six Northglenn locations. These counts represent the first on-street bicycle and pedestrian counts in the City.[1]

The data collected serves as an important baseline for future data collection efforts. However, it provides only a brief snapshot of bicycle and walking levels in Northglenn, and the counts are meant for planning purposes only. Research suggests that 2-hour peak morning and evening count data may differ according to transit times, school hours, weather conditions, and other factors. Weekend off-street counts may demonstrate increased bicycling and walking activities, compared to the counts shown here.

To increase the usefulness of the data collected, counts should continue to be conducted at the six locations during the morning and evening peak periods. This memorandum describes the data collected, and includes recommendations for next steps.

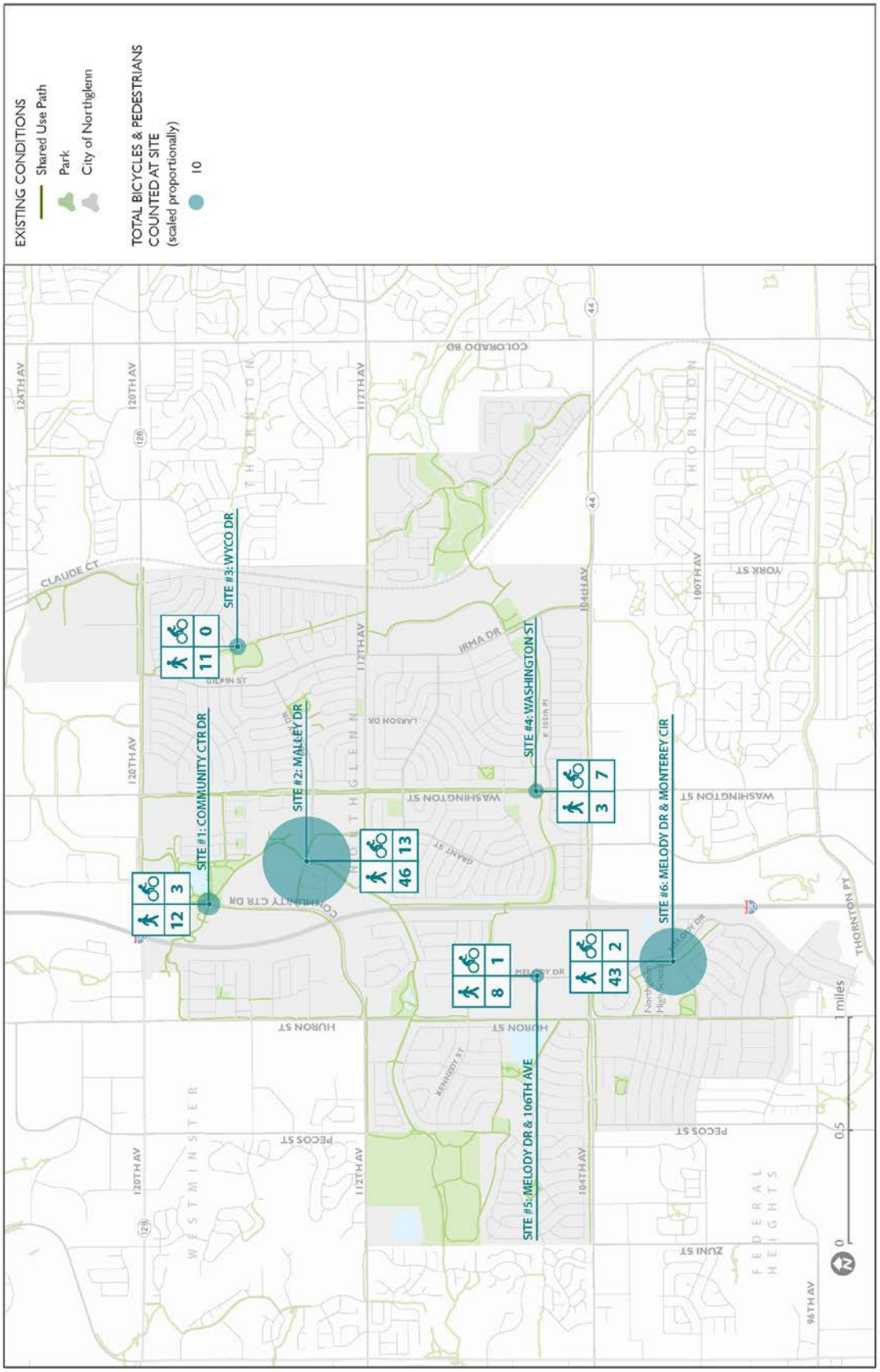
COUNTS LOCATIONS

Count locations were chosen due to their proximity to trails and key destinations to which people may walk or bike, such as parks and schools. The counts also represent the potential range for active transportation in the City. Figure F.1 on the following page displays the counts and count locations.

- **Site #1: Community Center Drive at Trail** – Bicycles and pedestrians moving north/south on Community Center Drive and east/west on the intersecting trail at the southwest corner of E.B. Rains Jr. Memorial Park.
- **Site #2**: **Highline Drive and Malley Drive** – Bicycles and pedestrians traveling north/south on the trail adjacent to Highline Drive and east/west on Malley Drive.
- **Site #3**: **West Wyco Drive and East 117th Way** – Bicycles and pedestrians going north/south on West Wyco Drive, east onto 117th Way, and west on the trail into Wyco Park.
- **Site #4**: **Washington Street Underpass** – Bicycles and pedestrians traveling east/west on the trail underneath Washington Street, near the east side of Grant Park.
- **Site #5**: **Melody Drive and West 106th Ave** – Bicycles and pedestrians moving north/south on Melody Drive and west on West 106th Avenue, on the west side of the Northglenn Marketplace.
- **Site #6: Melody Drive and Monterey Circle** – Bicycles and pedestrians going north/south on Melody Drive and west on Monterey Circle, just north of Northglenn High School.

[1] Previously, the City collected bicycle and pedestrian data on the pedestrian bridge over Interstate 25.

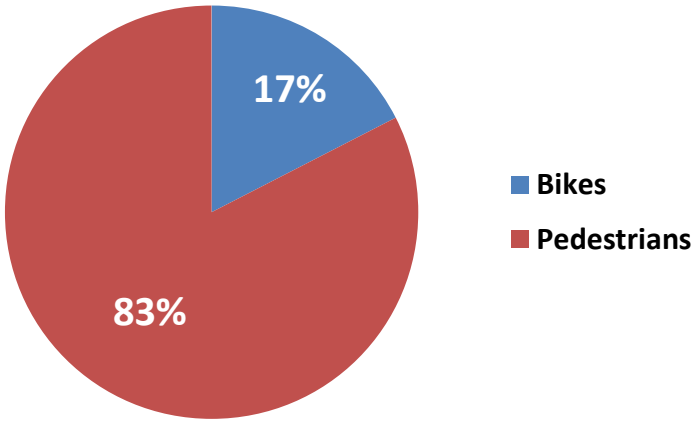
Figure F.1. Bicycle and Pedestrian Count Locations



CONCLUSIONS

The data collection sites recorded a total of 25 bicyclists and 123 pedestrians at the six sites. Of the pedestrians and bicyclists counts at the sites, pedestrians represented 83 percent of users and bicyclists represented 17 percent of users. This breakdown is displayed in Figure 1.

Figure F.2. Total bicycle and pedestrian users counted



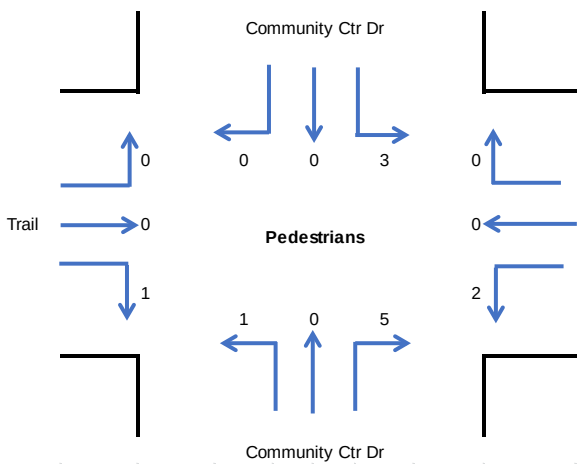
The trail intersection at Malley Drive (Site #2) had the highest number of users, with 13 bicyclists and 46 pedestrians, for a total 59 users. The lowest number of users were counted at Melody Drive and West 106th Avenue (Site #5), with one bicycle and eight pedestrians counted, for a total of nine users.

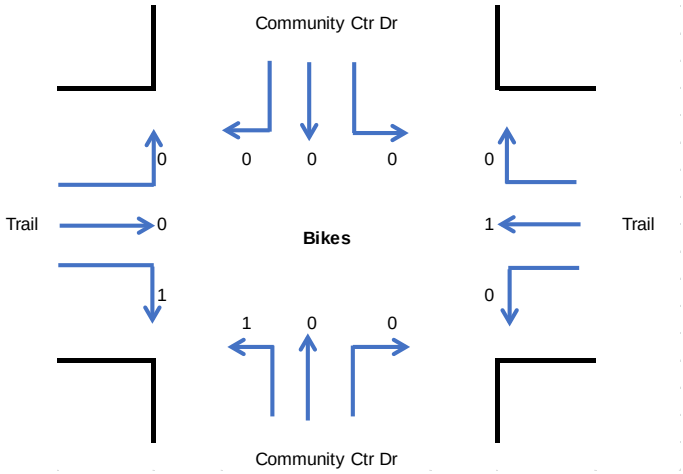
NEXT STEPS

The City of Northglenn should establish a bicycle and pedestrian count program. The sites counted as part of Connect Northglenn should be repeated as part of this program, and additional sites should be added as well. Future counts will help determine user trends over time, and are useful to assess the impact of infrastructure changes on active transportation patterns. The National Bicycle and Pedestrian Documentation Project (bikepeddocumentation.org) should be referenced to guide the development of the count program to establish a consistent methodology for the collection of bicycle and pedestrian data. Count Location Diagrams.

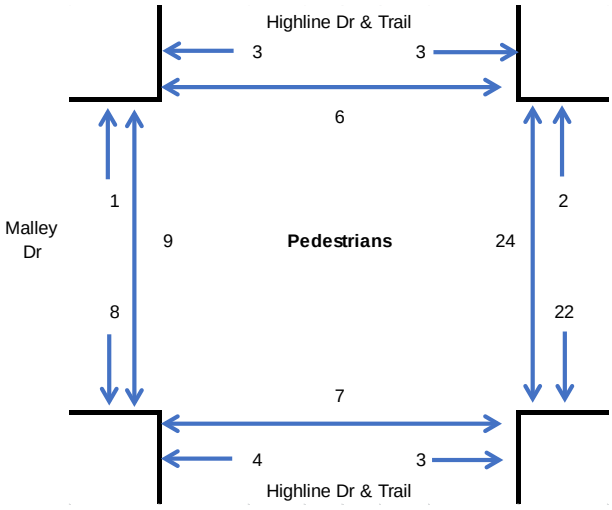
The diagrams on the following pages illustrate the movements of pedestrians and bicyclists counted at each location.

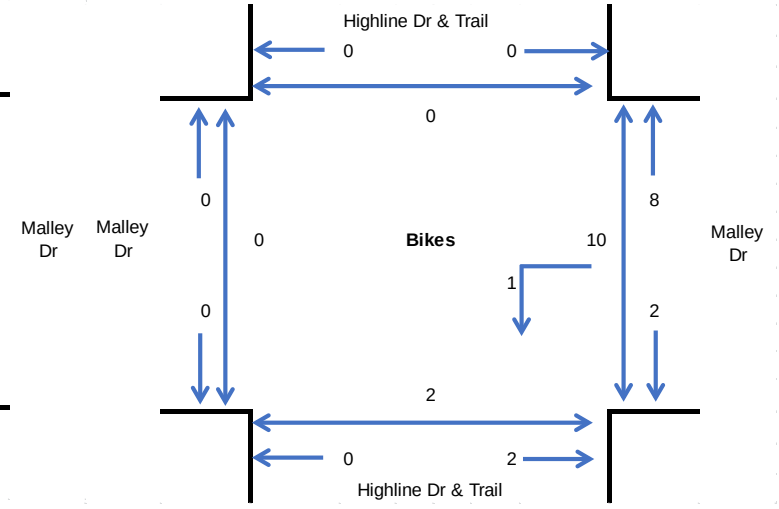
Site #1: Community Center Drive at Trail



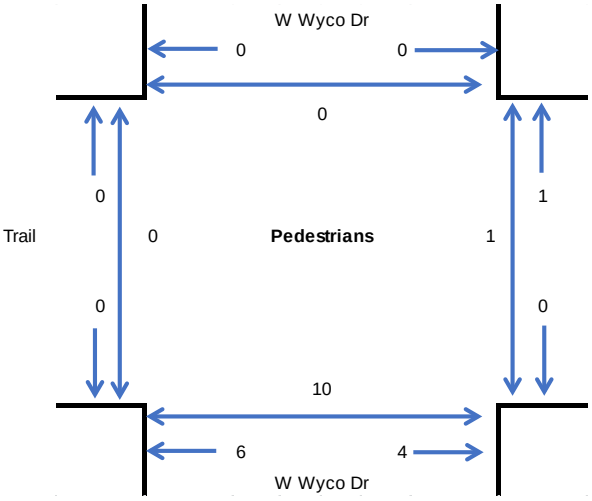


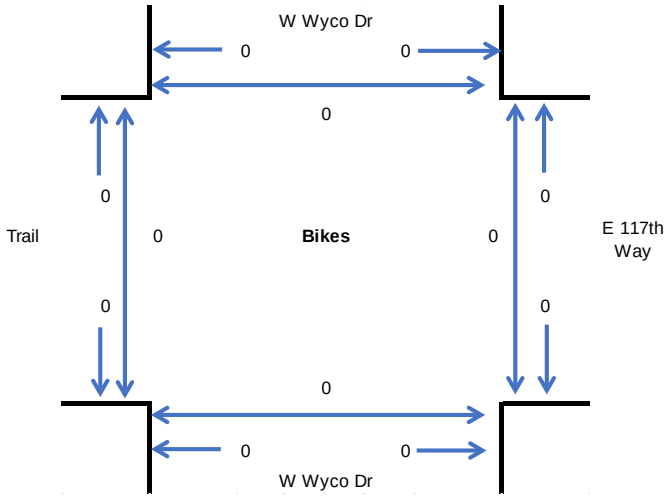
Site #2: Highline Drive and Malley Drive



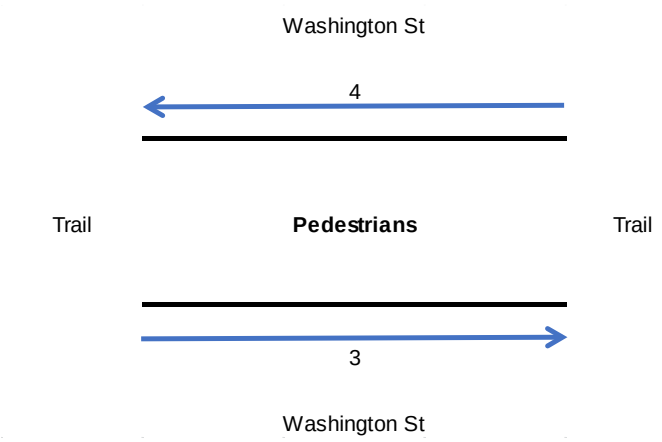


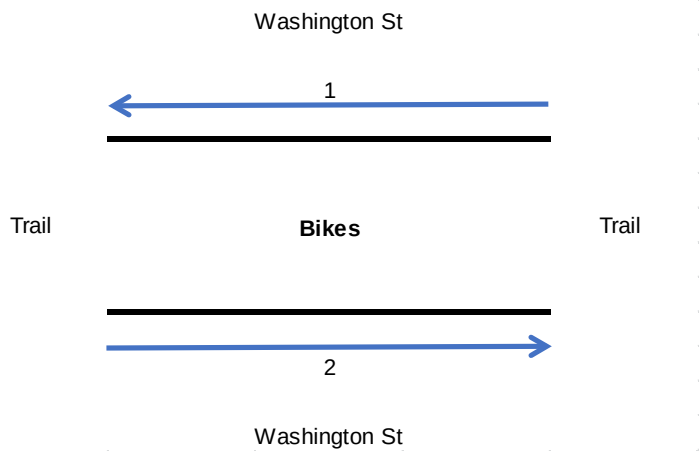
Site #3: West Wyco Drive and East 117th Way





Site #4: Washington St Underpass





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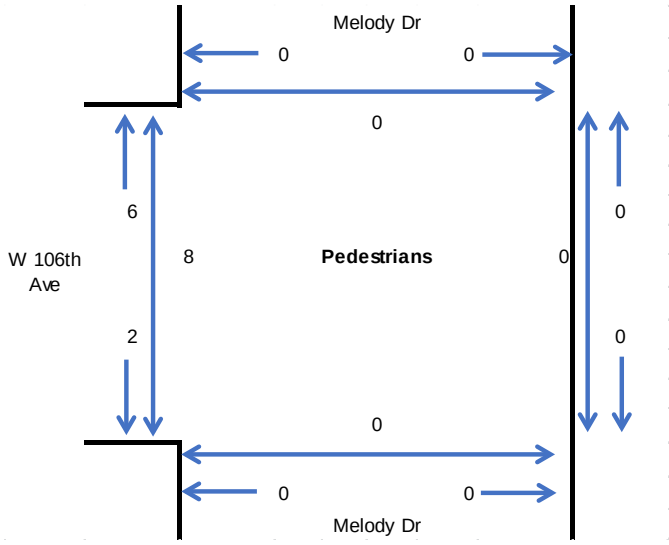
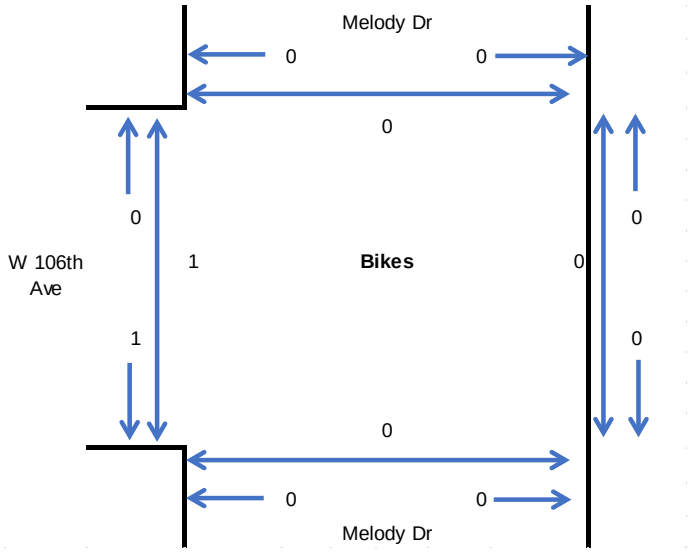
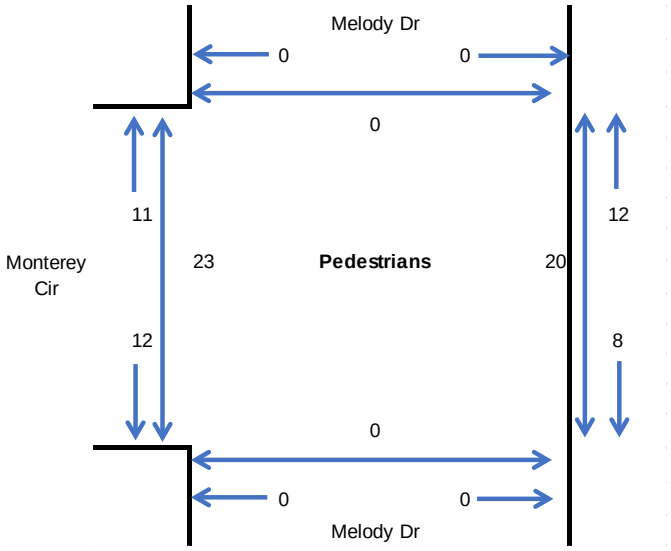
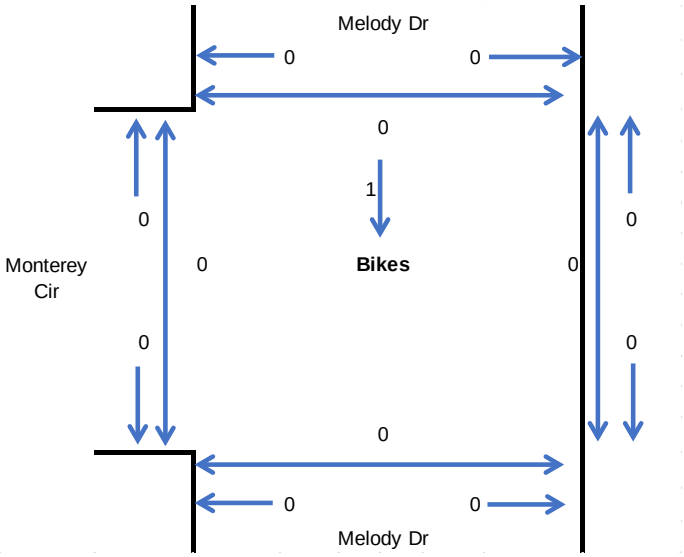




Site #6: Melody Drive and Monterey Circle





CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX G:

PROJECT RECOMMENDATIONS - DETAILED DESCRIPTION

CONNECT NORTHGLENN
BICYCLE AND PEDESTRIAN MASTER PLAN

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
1	Pecos St	Pecos St	104th Ave	Northglenn boundary	1.1	104th Ave	Northglenn boundary	Bike Lane	Retain parking on west side of Pecos St and stripe bike lanes on both sides of the road	--	--	9	Low
2	Croke Dr-97th Ave	Croke Dr; 97th Ave	104th Dr	Huron St	2.1	104th Dr	100th Pl	Neighborhood Bike/Pedway	Short term - stripe bike lanes	Long term - reconstruct roadway; Bike Lane Bike/Pedway cross-section recommended	--	20	High
					2.2	100th Pl	97th Ave	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	--		
					2.3	Croke Dr	Huron St	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section recommended		
3	Lou Dr-Fred Dr-Damon Dr-Trail Connection	Lou Dr; Fred Dr; Damon Rd	Huron St	Thornton Pkwy	3.1	Huron St	Lou Dr	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization<50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section recommended	20	High
					3.2	Switzer Ln	Melody Dr	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section		
					3.3	Switzer Ln	Thornton Pkwy	Trail	Construct 10' SUP	--	--		
4	103rd Ave	103rd Ave	Pecos St	Huron St	4.1	Pecos St	Huron St	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section recommended	21	High
5	100th Pl	100th Pl	Croke Dr	Melody Dr	5.1	Croke Dr	Melody Dr	Neighborhood Bike/Pedway	Short term - Install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section recommended	20	High
6	99th Ave	99th Ave	Croke Dr	Melody Dr	6.1	Croke Dr	Melody Dr	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks bike/pedway cross-section recommended	7	Low
8	Melody Dr-Bannock St-High school Trail Extension	Melody Dr; Bannock St	Bannock St Trail	104th Ave	8.1	Bannock St Trail	Existing Trail	Trail	Construct 10' shared use path connecting to existing trail; project will require easement from 2 private property owners	--	--	17	Medium
					8.2	Existing trail	104th Ave	Sidewalk	Restripe Bannock St: (2) 11' travel lanes and (1) 12' TWLTL; on west side, construct 7' sidewalk with 3' buffer	--	--		
9	Melody Dr	Melody Dr	112th Ave	Huron St	9.1	Huron St	104th Ave	Buffered Bike Lane	Short term - stripe 8' parking lanes, 5' bike lanes with 3' buffer, 10.5' travel lanes and 11' TWLTL; construct raised medians with vegetation as standard end-of-block treatment	Long term - reconstruct roadway; new cross-section: 8' sidewalks, 8' tree lawns, 7' bike lane with 3' buffer (raised buffered bike lane); 11' travel lanes (option removed TWLTL which is not needed given low volumes)	Long term - reconstruct roadway; new cross-section: 8' sidewalks, 4' tree lawns, 5' bike lane with 3' buffer; 11' travel lanes; 12' TWLTL (installing end-of-block raised medians with landscaping, or be landscaped for the entire corridor)	24	High
					9.2	Kennedy St	104th Ave	Buffered Bike Lane	Short term - conduct 5 to 3 lane road diet; repurpose outside lane as buffered bike lane (7' bike lane with 4' buffer)	Long term - reconstruct roadway; new cross-section: 8' sidewalks, 4' tree lawns, 5' bike lane with 3' buffer; 11' travel lanes; 12' TWLTL (installing end-of-block raised medians with land-scaping, or be landscaped for the entire corridor)	--		
					9.3	112th Ave	Kennedy St	Buffered Bike Lane	Short term - stripe 8' parking lanes, 5' bike lanes with 3' buffer, 10.5' travel lanes and 11' TWLTL; construct raised medians with vegetation as standard end-of-block treatment	Long term - reconstruct roadway; new cross-section: Shared Lanes with Tree Lawn Bike/Pedway Cross-section (maintaining parking both sides)	--		

CONNECT NORTHGLENN
BICYCLE AND PEDESTRIAN MASTER PLAN

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
10	Thornton Trail Connection	--	Melody Dr	Thornton Tpk	10.1	Melody Dr	Thornton Tpk	Trail	Construct 10' SUP; easement from at least 1 private property owner required; coordination with City of Thornton necessary	--	--	8	Low
11	104th Ave	104th Ave	Zuni St	Grant St	11.1	Zuni St	Huron St	Sidewalk Improvement	In coordination with property owners, assess opportunities to consolidate driveways along 104th Ave to reduce conflicts with pedestrians on sidewalk	--		18	Medium
					11.2	Melody Dr	Bannock St	Sidewalk Improvement	Remove existing sidewalk; construct 8' detached sidewalk on south side of 104th Ave; close driveways between Melody Dr and Bannock St to reduce conflicts; sidewalk construction requires removal of structure	--	--		
					11.3	Plaza Entrance	I-25 ramp	Sidewalk Improvement	Remove existing sidewalk, construct 8' detached sidewalk on north side of 104th Ave; construction will require removal of vegetation and Northglenn monument	--	--		
					11.4	SB Ramp	NB Ramp	Sidewalk Improvement	Stripe 11' lanes across bridge; using 18' excess width, reconstruct and widen both sidewalks by 9'; construct vertical barrier between	--	--		
					11.5	NB Ramp	Grant Dr	Sidewalk Improvement	Construct vertical railing between sidewalk and roadway (due to ROW constraint, buffer cannot be installed)	--	--		
12	Quivas St-Roseanna Dr	Quivas St; Roseanna Dr	104th Ave	Livingston Dr	12.1	104th Ave	Livingston Dr	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	25	High
13	Livingston Dr	Livingston Dr	104th Ave	112th Ave	13.1	104th Ave	Claire Ln	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	22	High
					13.2	111th Ave	112th Ave	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
14	Kennedy Dr	Kennedy Dr	Claire Ln	Acoma St	14.1	Claire Ln	Acoma St	Neighborhood Bike/Pedway	Short term - stripe bike lanes (west of Livingston Dr, if parking utilization >50% both sides, install shared lane marking treatment for this portion of Kennedy Dr)	Long term - reconstruct roadway; Bike Lane Bike/Pedway cross-section recommended (converting to shared lane markings west of Livingston if parking utilization >50% both sides)	--	22	High
15	Community Center Dr-112th Ave	Community Center Dr; 112th Ave	Alcott St	120th Ave	15.1	Alcott St	Huron St	Bike Lane	Restripe roadway to (4) 11' travel lanes, (1) 11' TWLTL, 5' bike lanes both sides	Assess conducting a 5 to 3 lane road-diet given volumes (<17,000 vpd makes it a good candidate); if dieted, install buffered sidewalk north side and wider on-street bike lanes	--	23	High
					15.2	Huron St	Malley Dr	Bike Lane	Stripe (2) 10' travel lanes in each direction, and 5-6' bike lanes	--	--		
					15.3	120th Ave	Malley Dr	Bike Lane	Stripe (3) 10' travel lanes and 5' bike lanes; bike lanes will visually narrow corridor, which could help to ameliorate documented speeding issues	Remove TWLTL, stripe (2) 11' travel lanes, 6' bike lanes, and 3' buffer	--		

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
16	Huron St	Huron St	112th Ave	96th Pl	16.1	112th Ave	104th Ave	Sidewalk Improvement	Assess consolidating driveways on east side of Huron St to reduce number of conflicts with pedestrians on sidewalk	--	--	25	High
					16.2	106th Ave	104th Ave	Sidewalk Improvement	Reconstruct west-side curb line; taper cross-section from 106th Ave south to existing attached sidewalk; from here south, reconstruct west-side sidewalk; new cross-section: 7' sidewalk, 4' buffer, (4) 11' travel lanes, (1) 14' TWLTL	--	--		
					16.3	104th Ave	100th Pl	Sidewalk Improvement	Remove existing sidewalk, and construct 8' sidewalk using existing tree lawn	--	--		
					16.4	Melody Dr	96th Pl	Sidewalk Improvement	Restripe roadway to (4) 11' travel lanes and (1) 12' TWLTL; reconstruct west curb (shifting it east); remove existing sidewalk and construct 8' sidewalk and 4' buffer	--	--		
17	106th Ave	106th Ave	Huron St	Melody Dr	17.1	Huron St	Melody Dr	Bike Lane	Stripe (3) 10' travel lanes and 5' bike lanes	Assess removing TWLTL in coordination with consolidating driveways along 106th Ave; stripe (2) 11' travel lanes, and 6' bike lanes with 3' buffer	--	12	Low
					17.2	Huron St	Melody Dr	Sidewalk Improvement	Assess consolidating driveways on north and south side of 106th Ave to reduce number of conflicts with pedestrians on crosswalk	--	--		
18	Justice Center Trail-Community Center Dr-Acoma St	Acoma St; Community Center Dr	W 114th Ave	Existing Trail	18.1	W 114th Ave	Community Center Dr	Trail	Construct 10' SUP	--	--	16	Medium
					18.2	West of Melody Dr	Proposed HAWK Beacon	Trail	Construct 10' SUP on City of Northglenn property; project will require easement from one private land owner	--	--		
					18.3	Community Center Dr	112th Ave	Trail	Construct 10' SUP on City of Northglenn and Westminster property; project will require removal of fence segments, and construction of fence between trail and water treatment facility	--	--		
					18.4	112th Av	Acoma St	Trail	Construct 10' SUP along City of Northglenn property; project will require relocation of existing fence	--	--		
					18.5	Northern Extent Acoma	Trail Crossing	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-	Long term - if parking utilization >50% both sides, Attached sidewalks bike/Pedway cross-section		
19	Community Center Dr Trail Connection	--	Malley Dr	Existing Trail	19.1	Malley Dr	Existing Trail	Trail	Construct 10' SUP; trail construction will require bridge over creek at southern end; grading required on approach and adjacent to Community Center Dr; path may need to narrow adjacent to road or retaining wall removed and replaced	--	--	15	Medium

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
20	Muriel Dr-Northglenn Dr-Emery Rd	Muriel Dr; Northglenn Dr; Emery Rd	Trail	Irma Dr	20.1	Trail	Muriel Dr	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	24	High
					20.2	Northglenn Dr	Irma Dr	Neighborhood Bike/Pedway	Short term - stripe bike lanes	Long Term - if parking utilization <50% both sides - Bike Lane Bike/Pedway cross-section recommended	Long Term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
21	Leroy Dr-107th Ave-Garland Dr	Leroy Dr; 107th Ave; Garland Dr	Lincoln St	Irma Dr	21.1	Lincoln St	Grant St	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - Attached Sidewalks Bike/Pedway cross-section recommended	--	22	High
					21.2	Grant Dr	Larson Dr	Neighborhood Bike/Pedway	Short term - stripe bike lanes	Long term - Bike Lane Bike/Pedway cross-section recommended (restrict parking north side of street)	--		
					21.3	Larson Dr	Irma Dr	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
23	Washington St	Washington St	120th Ave	104th Ave	23.1	Sylvia Dr	120th Ave	Sidewalk Improvement	Reconstruct road - stripe (6) 12' travel lanes, (1) 14' TWLTL, (2) 5' sidewalks both sides, (2) 4' landscaped buffers both sides; reconstruct raised medians	<Null>	<Null>	20	High
					23.2	115th Ave	Sylvia Dr	Sidewalk Improvement	Reconstruct road - stripe (4) 12' travel lanes, (1) 15' TWLTL, (2) 10' sidewalks both sides, (2) 5' landscaped buffers both sides; reconstruct raised medians	--	--		
					23.3	115th Ave	112th Ave	Sidewalk Improvement	Reconstruct road - stripe (4) 12' travel lanes; (1) 14' TWLTL; (2) 12' sidewalks both sides; (2) 9' landscaped buffers both sides; where cross-section widens to 6 lanes, narrow sidewalks to 10' and buffers to 5'; reconstruct raised medians	--	--		
					23.4	E 108th Ave	104th Ave	Sidewalk Improvement	Reconstruct road - stripe (4) 11' travel lanes, (1) 13' TWLTL, (2) 10' sidewalks both sides, (2) 5' landscaped buffers both sides; existing raised medians will require reconstruction; cross-section modification necessary at intersections	Where they currently do not exist, construct perpendicular curb ramps along entire corridor	--		
					23.5	Washington St	Larson Park	Sidewalk	Construction of sidewalk requires coordination with property owner	--	--		
					23.6	Garland Dr	--	Sidewalk Improvement	Reconstruct 5' minimum wide sidewalk in coordination with Starbucks redevelopment	--	--		
24	Grant Dr	Grant Dr	Malley Dr	104th Ave	24.1	Malley Dr	104th Ave	Neighborhood Bike/Pedway	Short term - if parking utilization <50% on both sides, stripe bike lanes; if utilization >50%, install shared lane markings and signage	Long term - Bike Lane Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	23	High

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
25	112th Pl-Highline Dr Trail Connection	112th Pl	Highline Dr	Grant Dr	25.1	Highline Dr	Grant Dr	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	16	Medium
					25.2	Highline Dr	Existing Trail	Trail	Remove existing sidewalk southeast side of road, and construct 10' sidepath; trail construction will require removal and replacement of bridge over creek	--	--		
					25.3	Highline Dr	Existing Trail	Trail	Construct 10' SUP connecting existing trail to Highline Dr	--	--		
26	112th Ave	112th Ave	Grant Dr	Washington St	26.1	Grant Dr	Washington St	Trail	Remove existing trail and replace with 10' wide SUP; install lighting along corridor	--	--	15	Medium
					26.2	Washington St	Trail	Sidewalk	Construct 5' sidewalk; provide two curb cuts for business access	--	--		
27	Melody Dr-114th Ave-Wagon Rd Pedestrian Connection	Melody Dr; 114th Ave	Wagon Rd Park N Ride	Melody Dr	27.1	Wagon Rd Park N Ride	Northglenn boundary	Sidewalk	Coordinate with RTD to stripe pedestrian lane or construct sidewalk through parking lot to connect trail to station	--	--	18	Medium
					27.2	Northglenn boundary	116th Ave	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
					27.3	115th Ave	114th Ave	Neighborhood Bike/Pedway	Short term - install shared lane marking and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
					27.4	114th Ave	W 114th Ave	Neighborhood Bike/Pedway	Install bike lanes on 114th Ave (restricting parking one side of the street); install bike lanes on Melody Dr from 114th Ave to W 114th Ave (restricting parking one side of street); install shared lane marking on W 114th Ave to proposed trail	--	--		
					27.5	Melody Dr	Development east	Sidewalk	Construct 6' attached sidewalk on south side of W 114th E	--	--		
28	120th Ave-I-25 Bridge	120th Ave; I-25 Bridge	1-25 Ramp SB	Grant St	28.1	1-25 Ramp SB	1-25 Ramp NB	Sidewalk Improvement	Reduce width of lanes on bridge to 11' on average; less 5' median, this provides 15' excess width; extend curb line and construct wider sidewalks both sides; construct vertical barrier; curb/ lane lines will require adjustment east-west of bridge	--	--	7	Low
					28.2	I-25 Off Ramp	Grant St	Sidewalk Improvement	Reduce width of 4 thru lanes to 11' each; this will provide 6 to 4' excess space; use space to extend curb line north and install 4'-6' buffer area	--	--		
29	Rec Center-I-25 Trail Connector	--	120th Ave	Community Center Dr	29.1	Existing Trail	120th Ave	Trail	Construct 10' SUP; filling and construction of retaining wall will be necessary; proximity to retention pond may require environmental permits	--	--	14	Medium
					29.2	Existing Trail	Community Center Dr	Trail	Construct 10' SUP; align trail to minimize removal of trees	--	--		

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
30	120th Ave Trail Connector	--	Existing Trail	120th Ave	30.1	Existing Trail	120th Ave	Trail	Construct 10 SUP' adjacent to creek in coordination with City of Thornton; may require environmental permits	--	--	10	Low
31	Plaza Trail-117th Ave Neighborhood Connector	118th Pl; Sherman St; 117th Ave; Lincoln St	118th Pl	116th Ave	31.1	Grant St	--	Trail	Construct 10' SUP to connect existing sidewalks; construction of trail will require coordination with two private property owners; trail construction will impact existing drive aisle and parking configuration	--	--	17	Medium
					31.2	118th Pl	116th Ave	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - Attached Sidewalks Bike/Pedway cross-section recommended	--		
32	117th Ave	117th Ave	EB Raines Park	Washington St	32.1	EB Raines Park	Washington St	Bike Lane	Restrict parking north side of street, and stripe (5') bike lane north side, (2) 11' travel lanes, (1) 6' bike lane south side, (7') parking lane	--	--	12	Low
					32.2	Pearl St	--	Sidewalk	Construct sidewalk segment from existing sidewalk east to Pearl St within existing landscaped area; this will align pedestrians directly with sidewalk on east side of Pearl St	--	--		
33	Ditch Trail East	--	Existing Trail	EB Raines Park	33.1	Existing Trail	EB Raines Park	Trail	Construct 10' SUP; given proximity to canal, environmental permits may be required; project will require coordination with up to 3 private property owners	--	--	16	Medium
					33.2	Proposed Trail	--	Trail	Construct short connection to private property trails	--	--		
34	Malley Dr West	Malley Dr	Community Center Dr	Washington St	34.1	Community Center Dr	Washington St	Buffered Bike Lane	Short term - restripe roadway to install buffered bike lanes: new cross-section: (2) 7' bike lanes, (2) 6' buffers, (2) 12' travel lanes, (1) 14' TWLTL	Long term - reconstruct roadway and install (2) 5' sidewalks,(2) 3' sidewalk buffers, 5' separated bike lane with 3' buffer from road (grade-separated), (2) 12' travel lanes, (1) 13' TWLTL	Long term - reconstruct roadway - install (2) 5' sidewalks, (2) 4' sidewalk buffers, 7' bike lane (at-grade), (2) 11' travel lanes, (1) 13' TWLTL	21	High
35	Sylvia Dr-119th Pl	Sylvia Dr; 119th Pl	Washington St	Claude Ct	35.1	Washington St	Claude Ct	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	16	Medium
36	Wyco Dr-Truda Dr	Wyco Dr; Truda Dr	Sylvia Dr	115th Ave	36.1	Sylvia Dr	Trail	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached sidewalks Bike/Pedway cross-section recommended	18	Medium
					36.2	Phillips Dr	115th Ave	Neighborhood Bike/Pedway	Short term - retain parking west side of road to facilitate school loading, stripe bike lanes	Long term - Bike Lane Bike/Pedway cross-section recommended (restrict parking east side of street)	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
37	Phillips Dr	Phillips Dr	Washington St	Claude Ct	37.1	Washington St	Claude Ct	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	20	High
38	Larson Ln-Larson Dr	Larson Ln; Larson Dr	Malley Dr	Trail	38.1	Malley Dr	Trail	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - given expected low volumes and number of driveways, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - Attached Sidewalks Bike/Pedway cross-section recommended	25	High

CONNECT NORTHGLENN
BICYCLE AND PEDESTRIAN MASTER PLAN

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
39	Malley Dr-115th Ave	Malley Dr; 115th Ave	Washington St	Claude Ct	39.1	Washington St	Irma Dr	Neighborhood Bike/Pedway	Short term - stripe bike lanes	Long term - Bike Lane Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	24	High
					39.2	Irma Dr	Claude Ct	Neighborhood Bike/Pedway	Short term - install shared lane markings and signage	Long term - if parking utilization <50% both sides, Shared Lanes with Tree Lawn Bike/Pedway cross-section recommended	Long term - if parking utilization>50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended		
40	Irma Dr North	Irma Dr	120th Ave	112th Ave	40.1	120th Ave	112th Ave	Neighborhood Bike/Pedway	Short term - given volumes, stripe bike lanes	Long term - given volumes, Bike Lane Bike/Pedway cross-section recommended	Long term - if removal of parking both sides deemed to be unacceptable, Attached Sidewalks Bike/Pedway cross-section recommended	13	Low
41	Karl Farms	Race St; 120th Ave	Irma Dr	Claude Ct	41.1	120th Ave	Existing east-west trail	Trail	Construct SUP with Karl Farm development	--	--	13	Low
					41.2	120th Ave	Existing east-west trail	Sidewalk	Install 6' wide (minimum) sidewalk on west side of Race St in coordination with redevelopment; maintain grass buffer	--	--		
					41.3	Irma Dr	Claude Ct	Sidewalk Improvement	With widening of 120th Ave to 6 lanes, construct 8-10' sidewalks with a minimum buffer of 5'	--	--		
43	112th Pl-Claude Ct	112th Pl; Claude Ct	Irma Dr	120th Ave	43.1	Irma Dr	120th Ave	Neighborhood Bike/Pedway	Short term - given volumes, stripe bike lanes	Long term - given volumes, Bike Lane Bike/Pedway cross-section recommended	Long term - if parking utilization >50% both sides, Attached Sidewalks Bike/Pedway cross-section recommended	16	Medium
44	RTD Commuter Trail	--	120th Ave	112th Ave	44.1	120th Ave	116th Dr	Trail	Construct trail along railway corridor	--	--	10	Low
					44.2	116th Dr	112th Ave	Trail	--	--	--		
45	York St	York St	112th Ave	116th Way	45.1	112th Ave	116th Way	Bike Lane	When properties along road are developed, install 6' bike lanes (minimum) and construct 5' sidewalks both sides (minimum) with buffers	--	--	5	Low
46	112th Ave East	112th Ave	Washington St	York St	46.1	Washington St	Trail	Sidewalk Improvement	Reconstruct existing sidewalk north side of road and construct 10' attached sidepath; project will require removal of existing landscaped buffer	--	--	14	Medium
					46.2	Washington St	York St	Bike Lane	Restripe roadway to (2) 10' travel lanes, (1) 1' TWLTL, 5' bike lanes both sides	Restripe roadway to (2) 10.5' travel lanes, (1) 10' TWLTL, 4' bike lane south side and 5' bike lane north side (due to gutter pan on north side)	Remove TWLTL from 112th Ave; stripe (2) 11' travel lanes and 7' bike lanes with 2' buffer, add turn lanes at intersections		
					46.3	112th Ave Crosswalk	York St	Trail	Construct trail connecting 112th Ave crosswalk and proposed trail on west side of railroad tracks to existing trail in Thornton; project will require at-grade crossing of railroad	--	--		
47	112th Ave-Fox Run Open Space-RTD Trail Connector	112th Ave	112th Ave	104th Ave	47.1	112th Ave Crosswalk	Proposed Trail south of 112th Ave	Trail	Remove existing sidewalk and construct 10' sidepath; project may require land acquisition from two adjacent landowners	--	--	16	Medium
					47.2	112th Ave	Fox Run Open Space	Trail	Coordination with railroad owner required	--	--		
					47.4	Trail	104th Ave	Trail	Construct 10' SUP; project will require coordination with RTD	--	--		
					47.3	Trail	Trail	Trail	Construct 10' SUP; project will require coordination with RTD	--	--		

Project Number	Project Name	Project Streets	Project Extent (from)	Project Extent (to)	Segment Number	Segment Extent (from)	Segment Extent (to)	Project Type	Option 1	Option 2	Option 3	Prioritization Score	Priority Level
48	Fox Run Parkway	Fox Run Parkway	112th Ave	--	48.1	112th Ave	104th Ave	Bike Lane	Restrict parking on one side of street, and stripe (5') bike lane on parking restricted side; new cross-section: (2) 11' travel lanes, (1) 6' bike lane (7') parking lane	--	--	15	Medium
50	Marion St	Marion St	Leroy Dr	104th Ave	50.1	Leroy Dr	104th Ave	Neighborhood Bike/Pedway	Short term - if parking utilization <50% both sides, stripe bike lanes; if utilization >50%, install shared lane markings and signage	Long term - Attached Sidewalks Bike/Pedway cross-section recommended	Long term - if parking utilization <50% both sides, , Bike Lane Bike/Pedway cross-section recommended	16	Medium
51	Irma Dr South	Irma Dr	112th Ave	104th Ave	51.1	112th Ave	104th Ave	Buffered Bike Lane	Short term - conduct 5 to 3 lane road diet, maintaining 1 travel lane in each direction and TWLTL; restripe wide outside lane as buffered bike lane (10' bike lane and 4' buffer) to provide added level of separation	Long term - reconstruct roadway (existing sidewalk edge to edge ~75) to (2) 6' sidewalk, (2) 4' tree lawns, (2) 7' bike lanes with 3.5' buffer, (2) 11' travel lanes, (1) 12' TWLTL	--	18	Medium
52	Leroy Dr	Leroy Dr	Rosalie Dr	Irma Dr	52.1	Rosalie Dr	Irma Dr	Sidewalk	Install 5' wide sidewalk with buffer on south side of Leroy; 2 utility cages may need to be relocated	--	--	11	Low
53	Jaycee Park Trail	Irma Dr	Irma Dr	Regatta Apts Driveway	53.1	Irma Dr	Regatta Apts Driveway	Trail	Construct 10' SUP; project will require grading to maintain ADA accessible grade on approach to driveway	--	--	10	Low
54	Railroad Trail	--	Leroy Dr	Leroy Dr	54.1	Leroy Dr	Leroy Dr	Trail	Use abandoned railroad ROW to construct 10' SUP	--	--	12	Low
55	Leroy Dr East	Leroy Dr	Irma Dr (north)	Irma Dr (south)	55.1	Irma Dr (north)	Irma Dr (south)	Buffered Bike Lane	Short term - stripe (2) 8' parking lanes, (2) 8' bike lanes with 4' buffer, (2) 11' travel lanes	Long term - reconstruct roadway, installing detached sidewalks west side of road (6' sidewalk and 4' buffer); remaining cross-section can stay consistent	Long term - reconstruct roadway and install buffered sidewalks and raised separated bike lane; new cross-section: west side sidewalk 10', west side buffer 4', raised separated bike lane 8' both sides, (2) 8' parking lanes, (2) 11' travel lanes	13	Low

CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX H:

STANDARDS AND SPECIFICATIONS REVIEW

CONNECT NORTHGLENN

Northglenn BICYCLE AND PEDESTRIAN MASTER PLAN

Appendix H: Standards and Specifications Review

Alta Planning + Design staff relied on national and local best practices, and its professional implementation experience, to review the City's Standards and Specifications, and make recommendations for how to better integrate bicycle and pedestrian facility guidelines, design details, and standards into the document. The following memo includes these recommendations, divided by chapter, section, and subsection of the 2015 "Public Right-of-Way Standards and Specifications Document." The final section of this memorandum presents recommendations specific to the detail drawings included in the Appendix of the "Standards" document. The complete Public Right-of-Way Standards and Specifications for the City of Northglenn can be viewed here.

Some sections include ***Topics for Consideration***. These recommendations represent internal conversations that should be initiated to discuss the policy goals of the community. Only after these conversations occur and consensus is reached, can the Standards and Specifications be updated. Overall, they represent longer-term recommendations.

CHAPTER 1

General Recommendation

Include a general statement in this chapter that Planning Division should review all improvements that impact the public realm, as well as transportation improvements that connect to private property. This will help to see that recommendations included in Connect Northglenn are reflected improvement projects.

1.2.6.8.2 Barricading and Traffic Control

Language regarding bicycle and pedestrian accommodation in work zones should be added to the first paragraph of this section. Such language will describe the need for contractors and other personnel to provide dedicated space for people walking and bicycling in construction zones, preferably physically separated from motor vehicle traffic and with special consideration given to the design at and near driveways, accesses, and intersections.

CHAPTER 6

6.2.2.1 Local

In subsection "a.", the City should change the maximum speed limit on the "Local" roadway classification to 25 miles per hour, removing the range "between 25 and 30 miles per hour." Twenty-five miles per hour is an appropriate speed for local roads, and lower speed roads are correlated with less severe crash injuries when people walking or bicycling are struck by a motor vehicle.

The standards and specifications include dimensions for new roadway construction projects. In subsection "o.", the City should reduce the curb and gutter pan combined width to two feet wide, made up of an 18" gutter pan and 6" (horizontal width) curb. This will reduce the standard gutter pan width by 8 inches. In constrained corridors where the gutter pan is included in the bike lane width, wider gutter pans present safety and operational issues for bike lanes striped adjacent to curbs. This recommendation is relevant for new roadway construction projects, or complete reconstruction of streets. The gutter dimension should not be changed when only a small portion of a roadway is being reconstructed. The gutter dimension should be changed if the road is being reconstructed on both sides between intersections. This change should be made universally to all curb and gutter standards for all roadway types (i.e. collector and arterial).

In addition, specific travel lane (18-22' combined travel way, minus parking) and bike lane (if applicable) widths should be described in this section, and a reference to the cross-section drawing in the appendix should be added.

6.2.3.1 Collector

In subsection "m.", it is recommended that the minimum sidewalk width on the "Collector" roadway classification be "six feet (6') minimum." The requirement for the sidewalk to be detached from curb should remain. A six-foot wide sidewalk will enable pedestrians (including people in wheelchairs or using other mobility-assistance devices), to safely pass one another.

In subsection, "n.", the City should reduce the curb and gutter pan combined width to two feet wide, made up of an 18" gutter pan and 6" (horizontal width) curb. Wide gutter pans present safety and operational issues for bike lanes striped adjacent to curbs (see qualifier for recommendation in section 6.2.2.1 Local above.)

A new subsection, "o.", should be added to this section below "n.", in which Section 6.2.3.1 will discuss the need for expressly delineated bike lanes on the "Collector" roadway classification. This section should then identify conventional and buffered bike lanes as being appropriate on this type of roadway. Providing dedicated space for bicyclists on higher volume and speed roadways helps to maintain comfort levels for bicyclists, makes movements between bicyclists and motorists more predictable, and reduces vehicle/bicycle conflicts.

In addition, specific travel lane (10-11') and bike lane widths should be described in this section as specified in the modified roadway classification details (Appendix).

6.2.4.1 Arterial

In subsection "i.", the second sentence should be revised to read as follows: "Arterials should act as boundaries between neighborhood areas*, while providing safe and comfortable bicycle and pedestrian connections across them to connect distinct neighborhoods*." New or revised text is *in italics*. Ensuring connections are made across arterials will increase access from neighborhoods to destinations.

In subsection "k.", the width and style of the furnishing zone or planting strip between the sidewalk and the curb should be specified. These details will provide more clarity regarding the organization of the overall sidewalk environment, while creating a comfortable and appealing pedestrian environment.

In subsection "l.", new or revised travel lane (11' max), median (15' where raised median exists at intersection; 11' where only paint), and bike lane widths should be described as specified in the modified roadway classification details (See Appendix-Details, page 11). Research indicates that narrower travel lanes do not negatively impact safety, while wider lane widths may adversely impact safety by inducing higher vehicle speeds. [1] The City should reduce the curb and gutter pan combined width to two feet wide, made up of an 18" gutter pan and 6" (horizontal width) curb (see qualifier for recommendation in section 6.2.2.1 Local above.)

The final part of the first sentence of this subsection should be modified to read: "plus acceleration/deceleration lanes at intersections*, where warranted by traffic study as well as the needs of adjacent developments and the City in general*." New or revised text is *in italics*. The addition of acceleration/deceleration lanes can reduce congestion, but they will also increase crossing distances for pedestrians. These trade-offs need to be documented and considered.

The standards and specifications include dimensions for new roadway construction projects. A new subsection, m.", should be added to this section below "l.", in which Section 6.2.4.1 will discuss the need for expressly delineated bike lanes on the "Arterial" roadway classification. This section will identify buffered and separated bike lanes being appropriate on this type of roadway, as well as type of physical separation appropriate for varying circumstances. To maintain comfort for bicyclists on high-speed, high-volume roadways such as arterials, bikeway facilities should be visually or physically separated from motor vehicle traffic. The standard should not be required when only a small portion of a roadway is being reconstructed. The standard should be required when the road is being reconstructed on both sides between intersections.

6.2.5 Drainage

In the introductory paragraph of this section, the second sentence should be modified to read: "Because safe and efficient movement of *motor vehicle, pedestrian, and bicycle* traffic is the primary function…" New or revised text is *in italics*. Without this qualification, "traffic" could be assumed to mean motor vehicle traffic only. Specifying that bicyclists and pedestrians are forms of traffic will help to ensure their needs are considered.

6.2.5.2 Inlets

This section should include guidance about the design and placement of bicycle-friendly inlets. In other sections, it describes the ADA standards of not placing inlets within the pedestrian's travel way,

[1] "A safety evaluation of lane widths for arterial roadway segments found no indication, except in limited cases, that the use of narrower lanes increases crash frequencies. The lane width effects in the analyses conducted were generally either not statistically significant or indicated that narrower lanes were associated with lower rather than higher crash frequencies. There were limited exceptions to this general finding." (Potts, Harwood, Richard, 2007). Additionally, "So long as all other geometric and traffic signalization conditions remain constant, there is no measurable decrease in urban street capacity when through lane widths are narrowed from 12 feet to 10 feet." (Zegeer 2007)

especially at the base of curb ramp. However, this section, and others, should be expanded to recommend or require that inlets be placed, generally, outside of the bicyclist's travel way. Best practices include using inlets with anti-slip properties to increase bicycle tire traction, using a hatched design (as opposed to a bar design), and if a bar design is being used, orienting the inlet bars perpendicular to the direction of travel

6.2.5.5 Manholes and Utility Covers (New Section)

A new section should be added that discusses locating manholes and utility covers (as recommended in Section 6.2.5.2) outside of the bicyclist's travel way and with a maximum grade difference of ¼" between the roadway's and the cover's or collar's surfaces, so long as the manhole or utility cover does not reside in the wheeled travel lane of the street. These recommendations may also be included in other sections that discuss such covers and accesses. The Appendix's Drawing No. SS12 appears to already reflect this recommendation.

6.2.6 Geometric Design

It is recommended that a verb softer than "consider" be used in this section, so that all geometric roadway design is not subject, formally or informally, to "the requirements of the local Fire District". This may help to ensure that the Fire District does not override sound engineering judgment and active transportation design best practices.

6.2.7 Sidewalks, Curb and Gutters, Ramps and Driveways

In subsection "B.", it is recommended that the language be changed so that required sidewalks or bicycle paths cannot simply be "deleted by action of City of Northglenn". For instance, the requirements for "deletion" should be clearly specified.

One of the first instances of the term "handicap ramp" in the "Standards" document is found in subsection "E." of Section 6.2.7. It is recommended that this term be changed globally throughout the document to reflect correct terminology, "accessible curb ramps", surrounding this facility design. In addition, in subsection "E.", the discussion of curb ramp designs and requirements should reflect this memo's recommended changes to the Appendix's curb ramp details, principally the replacement of diagonal curb ramps with perpendicular curb ramps.

6.2.8 Cul-de-Sacs

Topic for Consideration: Discuss internally if this section should identify or require strategies or designs to provide bicycle/pedestrian connections between abutting cul-de-sacs, while limiting access for motor vehicles. The implementation of such a requirement would improve street and path connectivity for active transportation users, connect neighborhoods, reduce trip distances, and encourage walking and bicycling for intra-neighborhood trips. These connections can be designed to also accommodate emergency vehicle movement.

6.2.9 Deceleration Lanes and 6.2.10 Acceleration Lanes

When designing deceleration and acceleration lanes, high-quality pedestrian and bicycle facilities should be maintained, and the quality of these facilities should not be compromised to accommodate the

acceleration/deceleration lane. For instance, if an acceleration lane is added and a bike lane is present leading to the location where the lane will start, the bike lane should not be dropped to accommodate the new lane. Similarly, sidewalk and planting strip widths should be maintained with the addition of the lane, and not narrowed or removed.

6.2.12 Barricades

This section should refer the reader to the required pedestrian and bicycle accommodations in work zones found in other sections.

6.4.6.4 Base Surface Tolerance

As specified in the recommendations for Section 6.2.5.5, this section should also specify that differences in grade at longitudinal, parallel seams or between utility and other covers and the roadway (perpendicular or parallel to the direction of travel) should not be greater than ¼". These maximum differences will ensure not only safer but more comfortable bicycling, as well as reducing potential for trip hazards when pedestrians are in the roadway. The Appendix's Drawing No. SS12 appears to already reflect this recommendation.

6.4.8.6 Opening to Traffic

This section should refer the reader to the required pedestrian and bicycle accommodations in work zones found in other sections.

6.4.9.4 Curb Cuts and Driveways

It is recommended that the access management strategies specified for each roadway classification be reiterated here, along with a more in-depth discussion about the benefits of access management for pedestrians, bicyclists, and other users at the edge of rights-of-way. The benefits should discuss reduced conflicts between pedestrian and bicyclists, which can improve both comfort and safety. In addition, the term "spacing" in the last sentence of this section should be defined in greater detail in order to differentiate between frequency and/or width. Page 15 includes best practices for driveway and sidepath design for bicyclists and pedestrians.

6.4.9.5 Curb Ramps

This section, among others, also includes the term "handicapped". It should be removed and language should be modified to reflect "accessible" as the preferred terminological root, as defined more clearly by the recommendations found in Section 6.2.7 "Sidewalks, Curb and Gutters, Ramps and Driveways" of this memo.

6.6.1 General (Construction Traffic Control)

In addition to referring the reader to the required pedestrian and bicycle work zone accommodations found in other sections, all of Section 6.6 "Construction Traffic Control" should incorporate national best practice for safe and comfortable bicycle and pedestrian work zone design and accessibility standards.[2]

[2] The City of Portland, OR Safe Accommodation for Pedestrians and Cyclists in and around Work Zones could be used as reference

6.6.2 Pedestrian Traffic

Requirements for pedestrian access found in subsection "A." should include slope, cross slope, and tolerance recommendations from the Americans with Disabilities Act (ADA) and the Public Rights-of-Way Guidelines (PROWAG).

The directions in subsection "D." should discourage, but still allow on a case-by-case basis, "divert[ing] pedestrians to the sidewalk on the opposite side of the street." Language should be added that also specifies that at locations where the distance between marked crossings is long, the diversion of pedestrians to the opposite side of the street should not be permitted. This will prevent pedestrians from having to walk considerably longer distances to access destinations.

6.6.3 Bicycle Traffic (New Section)

A section for accommodating bicycle traffic in construction zones should be added immediately following Section 6.6.2 "Pedestrian Traffic". These requirements may overlap with the pedestrian and the vehicular guidelines and standards. When that occurs, it may be wise to reprise the information again in those respective sections.

This additional section will require the renumbering of subsequent sections under Section 6.6, beginning with Section "6.6.3 Vehicular Traffic".

CHAPTER 7

7.2.7 Jointing

It is recommended that this section, and/or other appropriate sections in the document, require saw cut joints on concrete shared use paths or any other facility specifically designed for use by both bicyclists and pedestrians (including sidepaths and concrete shared use paths within the roadway right-of-way). Saw cut joints provide a smoother riding experience for bicyclists. Troweled or formed transverse joints are still acceptable joint types for curb, gutter, and sidewalks.

CHAPTER 8

8.1.2 Glossary of Terms

Topics for Consideration:

Under "Design Speed" in the Glossary, the text should be modified to reflect the desire of the City of Northglenn to have design speeds that are in accordance with the proposed or desired speed limit of the facility under design.

In the definition of "Design Vehicle", the "Standards" document should expand on the purpose and limitations of design vehicles in geometric roadway design and design speed. Design vehicles should be specific to the roadway type and to specific roadways within the City of Northglenn, and not dependent solely on the land use (i.e., commercial, residential, etc.). Each roadway's traffic profile, classification, volume, access management strategy, alley access, opportunities for loading and unloading, and other factors should also be considered. For example, the design vehicle for "Commercial Uses" is a WB40, or

a semi tractor-trailer. The City should reassess whether designing a roadway for a vehicle that likely makes infrequent trips and which may comprise a small percentage of overall traffic is worth the potentially adverse effects on the pedestrian realm. These effects include wider travel lanes and large turn radii required to accommodate WB40 vehicles. In addition to inducing higher vehicle speeds, both factors increase the crossing distance for pedestrians, which increases exposure (or the probability that a pedestrian could be struck while crossing the roadway) and decreases pedestrian comfort levels.

Under "Fire Trucks", the City of Northglenn should consider the different models of fire and emergency responders' vehicles, especially those currently and planned to be operated by the North Metro Fire Rescue District.

8.2.1 Responsibilities for Traffic Studies

The second sentence of the final paragraph of this section should read: "As a minimum, topics for possible discussion at such meeting shall include trip generation, directional distribution of traffic, trip assignment, *bicycle and pedestrian accessibility*, definition of the study area, intersections requiring capacity/level of service analysis and methods for projecting build-out volume." New or revised text is *in italics*. Including bicycle and pedestrian accessibility as a discussion item will help to see that the needs of bicyclists and pedestrians are assessed.

8.2.2.1 Introduction (Traffic Study Format)

In subsection "b.", a sentence should be added between the second and third sentences to read: "…area shall be identified. *In addition, all bicycle and pedestrian facilities leading to the development shall be inventoried.* The exact limits…" New or revised text is *in italics*. Including bicycle and pedestrian facilities in the existing conditions inventory will ensure that these modes, and their associated needs, are considered at the outside of the traffic study.

The map, referred to in subsection "e.", should also display proposed bicycle and pedestrian facilities.

Topic for consideration: In subsection "c.", Northglenn could consider modifying the last sentence (and perhaps other sentences and recommendations in that same paragraph) to reflect a more holistic approach to estimating the impact of trip generation. Internally, it should be acknowledged that models have imperfections, and these imperfections should be taken into consideration as traffic analysis is used to inform planning and design. **It is acknowledged that changing the standard approach to traffic study format is complex, however, initiating a conversation around the policy objectives of the community, and how the city's traffic analysis tools can support these objectives, is important.**

For instance, consider that the existing methodology focuses on the "the highest trip generation", or the worst-case scenario. Consider also that this focus on the worst-case scenario could result in a roadway being designed with far greater capacity than is needed under typical conditions. Also, wider roads are more expensive to maintain. Assessing the probability of this 'worst case scenario' and weighing the benefits and trade-offs, especially related to the impact on bicycle and pedestrian travel, is important.

Consider also that multilane roadways that carry less capacity than their design volume can encourage excessive vehicle speeds, which negatively impacts bicyclists, pedestrians, and can present safety issues

for all modes. Additionally, multilane roadways take longer to cross for pedestrians and bicyclists, increasing exposure. Analysis conducted for Connect Northglenn concluded that roadways operating under capacity exist in Northglenn. The City should initiate internal conversations about the goals of the City's trip generation model.

8.2.2.2 Trip Generation and Design Hour Volumes

***Topic for consideration*:** When data is available, actual trip generation data from similar and existing land uses in Northglenn and its environs should supplement data and direction from the examples included in the Institute of Transportation Engineers (ITE) Trip Generation Manual. The usage of local trip generation data could provide more accurate trip generation rates than rates based solely upon the ITE Manual, especially for land uses that have a small sample size in the ITE Manual, or for land uses that are unique and that may not have an accurate comparison in the manual.

Consider in subsection "b.", the sentence could be modified to read: "Traffic volume counts for similar existing uses *in Northglenn or immediately adjacent communities* if no published rates are available." New or revised text is *in italics*. Again, emphasizing the use of local data could provide more accurate trip generation rates.

It is recommended, that during internal discussions, it should be noted that the provision and use of bicycle and pedestrian facilities could reduce motor vehicle trip generation. While new development may increase traffic to the site, careful land use and transportation planning coordination can help to manage the impact of this increase in traffic, especially if comfortable bicycle and pedestrian connections are integrated into the development and the surrounding area. Omitting bicycle and pedestrian connections could result in a lack of sufficient facilities, which could result in more people driving to the site who may have otherwise walked or bicycled there, if convenient connections were provided.

8.2.2.5 Existing and Project[ed] Traffic Volumes

The title of this section should be revised to read: "Existing and Project*ed* Traffic Volumes". Generally, this section should be revised to include discussion about the requirement to consider bicycle and pedestrian level of service and comfort in all roadway design and planning decisions.

Topic for consideration: It should be acknowledged internally that focusing exclusively on peak hour traffic can result in roadways that are capable of providing efficient service during peak hours, but which operate under capacity for the majority of the day. Designing for the peak hour, or peak 15-minute period, is a policy decision, and the benefits and trade-offs of this policy should be discussed. Wide roadways contribute to a reduction in active transportation user comfort and safety, as well as diminished remaining space for facilities for those users. Consider assessing peak hour congestion rates compared to the impact on bicycle and pedestrian mobility as part of this conversation. For instance, consider the increase in crossing distance for pedestrians required by the addition of a dedicated turn lane, and the reduction in vehicle level of service of not providing this turn lane would cause.

8.2.2.8 Traffic Signals

Topic for consideration: The third sentence should be revised to consider the need for shorter intervals (1/8 to 1/4 mile) between pedestrian and bicycle crossing beacons (e.g., hybrid beacons, Toucans, and even RRFBs, where appropriate), in addition to the signalized crossings on a ½ mile spacing interval. The appropriateness of implementing this recommendation requires assessment on a case-by-case basis, but the general intent is to increase the frequency of marked crossing locations for pedestrians, which along arterial and collector roadways, are currently at relatively long distances. Research suggests long distances between marked crossings present challenges for bicyclists and pedestrians, and can discourage walking and bicycling activity. More frequent marked crossings for bicyclists and pedestrians can facilitate and encourage active transportation by shortening distances to destinations.[3] A safety benefit can also be realized. Marked crosswalks encourage bicyclist and pedestrians to cross where formalized crossing treatments exist, thereby making their movements more predictable to motorists.

Figure H.2. Video detection

The final sentence of the first paragraph should be modified to read: "Pedestrian *and bicycle* movements shall be considered in the evaluation and adequate pedestrian *and bicycle* clearance provided in the signal cycle split assumptions." New or revised text is *in italics*.

Figure H.1. Radar detection

Signals should be updated to detect bicyclists at intersections. This technology enables bicyclists to trigger the signal, and can facilitate crossing major streets, where side streets are given the green phase only when motor vehicles are present. In-pavement loop detection is not recommended as a means of bicycle detection in Northglenn, since it can be labor intensive to install and is less reliable than newer technologies. Recommended technologies include:

- Video Detection- Video detection aimed at bicycle approaches and calibrated to detect bicyclists.
- Microwave Detection – Radar
- Infrared Detection– Thermal sensor
- Push-button – User activated button mounted on a pole facing the street

8.2.2.9 Traffic Accidents [Crashes]

The term "accident" should be changed globally throughout the document, including in the title and text of this section, to reflect correct terminology: "crashes" or "collisions". This change helps to emphasize that crashes are not accidents, but are caused by human error and/or roadway design issues.

[3] Designing Walkable Urban Thoroughfare: A Context Sensitive Solution, The Institute of Transportation Engineers (ITE), 2010

The first sentence of this section should be modified to read: "*Vehicular, bicyclist, and pedestrian* traffic *crash* data for affected street corridors may be required for the study." New or revised text is *in italics*. Assessing crash data for all modes could result in safety improvements for bicyclists and pedestrians in the study area. It is recommended that the duration of study period be lengthened to 5 years, which is the standard for assessing bicycle and pedestrian crash data.

8.2.2.11 Recommendations

In subsection "a.", the first sentence should be modified to read: "This section must describe the location, nature and extent of proposed improvements to assure sufficient roadway capacity *and safe and comfortable bicycle and pedestrian accommodations*." New or revised text is *in italics*. This will reinforce the need to consider bicyclists and pedestrians in roadway improvement projects.

***Topic for Consideration**:* In subsection "b", the text states that the level of service must be "D" or better. Consider including text to specify if this level of service must be maintained for the peak hour, or is the daily average. As a point of discussion, designing roadways for the peak hour, when the worst congestion is to be expected, can result in excessively wide roadways, that during the other 22 hours per day, operate under capacity. Target LOS scores are a policy decision that the community should assess on a case by case basis, weighing the benefits and trade-offs of varying roadway configurations, and their impact on bicycle and pedestrian mobility.

8.2.3.2 State Highways

The following sentence should be added to the end of subsection "b.": "*The CDOT Bicycle and Pedestrian Coordinator should be directly involved in the granting of all permits for state highways in the City of Northglenn in order to ensure that appropriate facilities are provided or protected.*"

8.2.3.3 Arterials

It is recommended that a sentence be added to the end of the paragraph of item "2)" in subsection "c.", which reads: "*Any negative impacts to pedestrian and bicycle mobility and safety should be identified and mitigated if more than one access is desired*." This language helps to emphasize that increasing the number of access points also increases potential conflict points with bicyclists and pedestrians.

8.2.3.4 Collectors

The second sentence of this section, which reads: "Single-family residence access to collectors is not permitted" may indicate that on-street parking is in greater demand on these roads. This could result in more on-street parking demand. Where collectors are developed, on-street parking availability should be assessed on adjacent streets so that adequate parking is available, and if necessary, parking can be limited on the collector roadway to provide space necessary for on-street bike lanes.

A new sentence should be added after the second sentence, which reads: "*If and where allowed, private uses should be limited to one access point per use, consistent with the access management strategy on arterial roadways in Section 8.2.3.3.*"

8.2.3.6 Basic Principles for Curb Openings and Driveways

The second sentence in the first paragraph should be revised so that the end reads: "…while at the same time minimizing the interference to the traffic using the street *and the impact to safety and comfort for pedestrians and bicyclists*." New or revised text is *in italics*. This broadening of the term 'traffic' will help ensure the potential impacts to bicyclists and pedestrians are assessed and mitigated.

8.6 Materials Specifications

This memo recommends that a new section, titled "Bicycle Detection", be added under Section 8.6 (as a new Section 8.6.5), requiring the renumbering of subsequent sections, beginning with the former Section 8.6.5 "Detectors (Pedestrian Push-Button)". This section will address bicycle detection best practices, placement, and materials.

8.6.7 Controller Cabinet

A requirement should be added to this section expressly prohibiting placing controller and other cabinets within the pedestrian travel way, especially as such placement would infringe upon accessibility and ADA standards.

APPENDIX – DETAILS

Drawing No. R1 – Local Typical Section

Local w/ Attached/Detached Walk

On every roadway classification's typical section in this section of this memo, it is recommended that the pavement width be better defined, at least with options. The need for parking, travel lanes, or types of on-street bicycle facilities may differ within the same classification, but, to the extent possible, typical sections should improve the definitions of that space. In addition, lane width recommendations from Section 6.2 should be reflected in these drawings.

Northglenn should consider adapting the typical sections for Neighborhood Bike/Pedways into the local typical section drawing.

Local w/ Detached Walk

Improving the scale in this and/or the above drawing so that the 30' of pavement and the 60' overall right-of-way are the same widths will help to better visualize the roadway and its implied and expressly drawn and stated requirements.

Drawing No. R2 – Collector Typical Section

Bike lanes should be required on collector classification roadways. Within 37' of asphalt, bike lanes are possible where only one side of parking is warranted, and no two-way left turn lane is provided. Within 49' of asphalt, bike lanes and parking on both sides can be accommodated; however, if a two-way left turn lane is provided, parking may need to be replaced by bike lanes.

On every roadway classification's typical section in this section of this memo, it is recommended that the pavement width be better defined, at least with options. The need for parking, travel lanes, or types of on-street bicycle facilities may differ within the same classification, but, to the extent possible, typical sections should improve the definitions of that space. In addition, lane width recommendations from Section 6.2 should be reflected in these drawings, namely 11' lanes.

Drawing No. R3 – Arterial Typical Section

This memo recommends that physically separated bike lanes (at least 6' of bike lane and 3' of separation) be implemented on all arterial classification roadways, and expressly included in this typical section. Such provision may require reconfiguration of the existing cross-section.

The section drawing should also note that, in lieu of the provision of separated bikeways, the 8' walk could be widened on both sides of the street to 10', providing necessary width for a sidepath that could be shared by both bicyclists and pedestrians.

On every roadway classification's typical section in this section of this memo, it is recommended that the pavement width be better defined, at least with options. The need for travel lanes, or types of on-street bicycle facilities may differ within the same classification, but, to the extent possible, typical sections should improve the definitions of that space. In addition, lane width recommendations from Section 6.2 should be reflected in these drawings, namely 11' travel lanes and 15' medians.

Drawing No. R6 – Curb Ramp Combination, Curb Gutter and Walk

The recommended changes to Section 6.2.7 include the replacement of diagonal curb ramps with perpendicular curb ramps. This recommendation should be reflected in Drawing No. R6 in the Appendix. Perpendicular curb ramps are simple to implement with detached sidewalks leading into the intersection, even on wide roadways as shown in the photo examples from Colorado Springs:

Figure H.3. Perpendicular curb ramp

Figure H.4. Perpendicular curb ramp

These photos present options for installing perpendicular curb ramps at intersections with large turn radii. Attached sidewalks can be routed away from the corner, providing space for the installation of perpendicular curb ramps (images: Colorado Springs, CO; image source: Google Maps)

Where attached sidewalks meet, bending them away from the street (and potentially acquiring an easement from the adjacent property owner, if necessary) in order to create the space for perpendicular ramps may be necessary.

Adequate drainage upstream and downstream of the curb ramp will ensure that pooling does not occur here (See figure 7-42). This change is recommended to improve access and comfort for those with physical disabilities and/or using mobility assistance devices (i.e., wheelchairs, canes, walkers), which will only deteriorate further once the roadway is resurfaced and material at its edge is built up. It also helps to prevent ice formation and water ponding, which can also pose safety hazards.

***Topic for Consideration**:* Alta recommends removing the drawing for diagonal curb ramps from the standards and specifications, and/or include language that expressly prohibits them in new construction and strictly limits their application in roadway retro-fit projects. Both FHWA and CDOT do not recommend them.[4]

Figure H.5. Poor curb ramp design (Image Source: nacto.org)

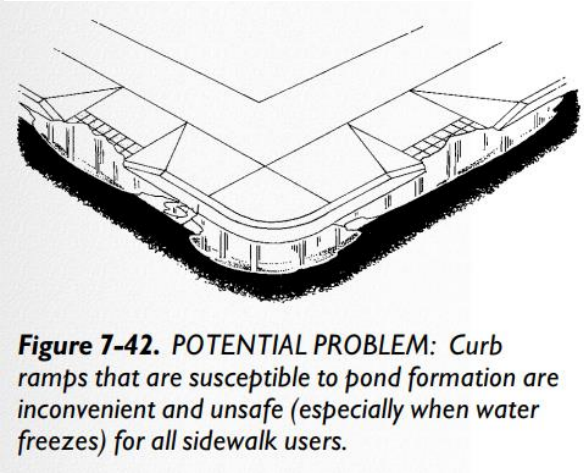


Figure 7-42. *POTENTIAL PROBLEM: Curb ramps that are susceptible to pond formation are inconvenient and unsafe (especially when water freezes) for all sidewalk users.*

Figure H.6. Good curb ramp design (Image Source: nacto.org)

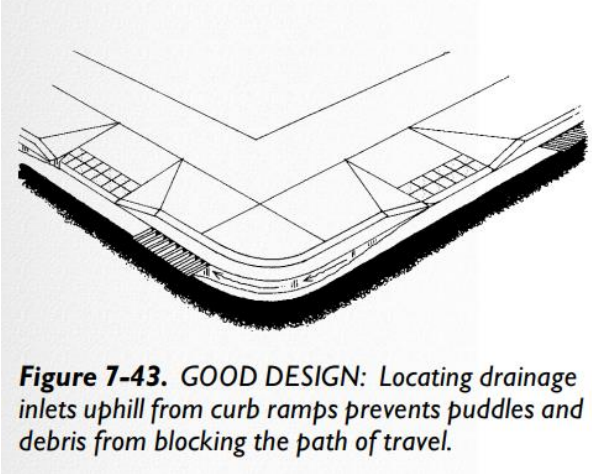


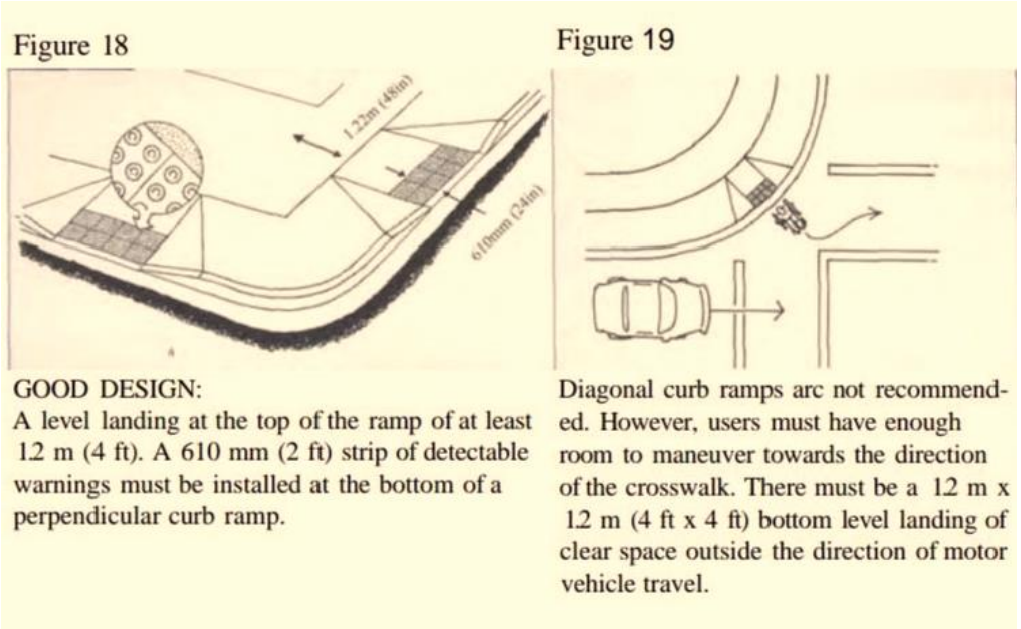
Figure 7-43. *GOOD DESIGN: Locating drainage inlets uphill from curb ramps prevents puddles and debris from blocking the path of travel.*

[4] FHWA "Diagonal curb ramps are never ideal and should be avoided in new construction"; CDOT "Diagonal curb ramps are not ideal and are permitted only on alternation projects with MEF justification"

Drawing No. R8 – Sidewalk Ramp with Cross Pan, Vertical Curb

This memo recommends that this drawing be revised to improve the transition from and slope between the depressed gutters in intersections and the curb ramps themselves. Though this may be remedied through the implementation of perpendicular curb ramps, the revision of the diagonal curb ramp transition in this drawing will improve accessibility and comfort for non-motorized users, especially for those with mobility assistive devices. Figure 19 specifies that, where diagonal curb ramps are present, a 4' x 4' box must be maintained outside the direction of motor vehicle travel.

Figure H.7. Good curb ramp design (Image Source: FHWA)

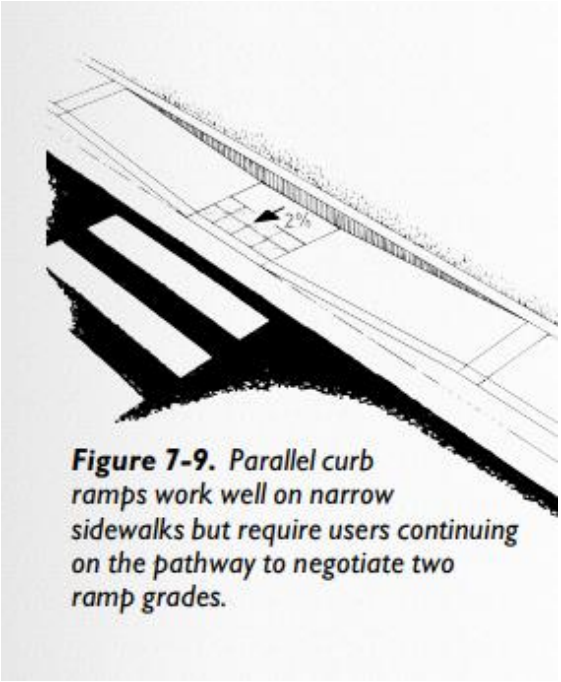


Drawing No. R9 – Ramp Drive for Vertical Curb, Attached Walk

The top drawing on this sheet does not reflect the preferred curb ramp design for attached sidewalks. This drawing, and others, should be revised following the guidance provided by the Federal Highway Administration's (FHWA) "Designing Sidewalks and Trails for Access, Part II of II: Best Practices Design Guide". Figure 7-9 from that Guide may be particularly helpful for the revision of Drawing No. R9.[5]

In addition, it is recommended that any lip between the gutter and the ramp, but especially a 1" lip, be removed. Drainage improvements upstream and downstream may be required to prevent pooling at the bottom of the ramp.

Figure H.8. Parallel curb ramps (Image Source: nacto.org)



[5] https://nacto.org/docs/usdg/designing_sidewalks_and_trails_access_kirschbaum.pdf

Drawing No. R10 – Ramp Drive for Vertical Curb and Detached Walk

It is recommended that any lip between the gutter and the ramp, but especially a 1" lip, be removed. Drainage improvements upstream and downstream may be required to prevent pooling at the bottom of the ramp.

Drawing No. SS10 – Encasement for Conduit Crossings

The recommendations for maximum elevation tolerances between surfaces and covers from Sections 6.2.5.5 and 6.4.6.4 should be reflected in this drawing. Drawing No. SS12 seems to already reflect this recommendation.

Drawing No. ST5-A – Curb Inlet Type R

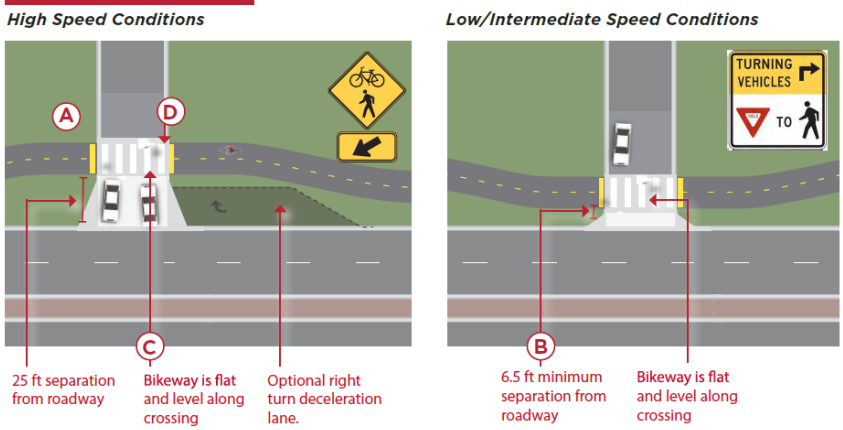
The recommendations for bicycle-safe inlet design from Section 6.2.5.2 should be reflected in this drawing.

BEST PRACTICES FOR DRIVEWAY AND SIDEPATH DESIGN

SIDEPATH CROSSINGS

Sidepaths provide a high degree of comfort on long uninterrupted roadway segments, but have operational and safety concerns at driveways and intersections with secondary streets. Crossings should be designed to promote awareness, and facilitate proper yielding of motorists to bicyclists and pedestrians.

Relative Cost: Medium



Typical Application

- At controlled and uncontrolled sidepath crossings of driveways or minor streets.
- Used to provide for visibility and awareness of the crossing by motorist in advance of the crossing.
- Increases the predictability of sidepath and road user behavior through clear, unambiguous right of way priority.

Design Features

- (A) The sidepath should be given the same priority as the parallel roadway at all crossings.
- (A) Provide clear sight triangles for all approaches of the crossing.
- (B) Maintain physical separation to the crossing of 6.5 to 25 ft. (Scheppers 2011). As speeds on the parallel roadway increase, so does the preference for wider separation distance. (FDOT 2005).
- (C) Configure crossings with raised speed table and median safety island
- (D) Use high visibility crosswalk markings to indicate the through area of the crosswalk.

Further Considerations

- Sidepaths running for long distances in suburban areas with many driveways or street crossings can create operational concerns. See the figure above for potential conflicts associated with sidepath crossings. (AASHTO 2012)
- Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the path.
- The provision of a shared use path adjacent to a road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities.
- To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street. (AASHTO 2012)

Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority. Thermoplastic or epoxy markings offer increased durability over conventional paint.

References

AASHTO. Guide for the Development of Bicycle Facilities. 2012.

Schepers et al. Road factors and bicycle—motor vehicle crashes at unsignalized priority intersections. Accident Analysis & Prevention. Volume 43, Issue 2, 2011.

Florida Department of Transportation (FDOT). Sidepath Facility Selection and Design. 2005.

CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX I:

COST ESTIMATES

Connect Northglenn

Concept Project Cost Estimates

Notes:

1. The following pages include costs for recommended "Concept Project" improvements for five corridors in the City of Northglenn, Colorado. These projects were developed as part of the Connect Northglenn plan.
2. These costs are intended to be planning level (within 30%) and include only labor and materials. They do not include design and engineering, traffic control, adjustments for inflation, property acquisition, and other non-labor and non-materials costs. A 20% contingency is included in a sub-row below each subtotal and final total.
3. Each corridor is, if necessary, divided into segments. Segments represent where there are different alignments, widths, constraints, or elements that affect costs.
4. Corridors or segments without pavement management/resurfacing costs are assumed to be resurfaced through the City's regular maintenance program before implementation of the recommend "Concept Project".
5. At the end of each project, below all of the itemized and subtotaled costs, are the final costs for the corridor in question.

Features and costs for the Concept Projects listed below are privided on the following pages

1. Community Center Drive (120th Ave to Huron St)
2. Malley Drive West
3. Washington Street
4. Melody Dr
5. Irma Drive

Produced by: Alta Planning + Design, December 2017

1. Community Center Drive Concept Project

Section From	*Section To*	*Element*	*Sub-Element*	*Quantity*	*Unit*	*Unit Price*	*Sub-Element Cost*	*Element Cost*
120th Ave	Malley Dr	**Bike Lane Thermoplastic Striping**	Bike Lane Interior Stripe (Parking Side) (4")	8,000	LF	$3.39	$27,120	**$64,773**
			Bike Lane Exterior Stripe (6")	8,000	LF	$4.00	$32,000	
			Bike Lane Symbol	27	EA	$212.00	$5,653	
			TWLTL Yellow Solid Stripe (4")	8,000	LF	$3.39	$27,120	**$37,200**
			TWLTL Yellow Dashed Stripe (4")	8,000	LF	$0.59	$4,680	
			TWLTL Double and Single Turn Arrow Symbols	18	EA	$300.00	$5,400	
		Midblock Crossing #1	Raised Median Curbing (120' x8')	252	LF	$4.00	$1,008	**$19,881**
			Raised Median Excavation/Prep	53	CY	$25.00	$1,333	
			Raised Median Colored Concrete Pavers	880	SF	$12.00	$10,560	
			Concrete Flatwork for Median Crossing/Landing	80	SF	$11.00	$880	
			High Visibility Patterned/Paver Thermoplastic Crosswalk	500	SF	$8.00	$4,000	
			Thermoplastic Stop Bars in Travel Lanes	20	LF	$15.00	$300	
			Pedestrian Crossing Warning Signage Assemblies	4	EA	$300.00	$1,200	
			Optional ($ not incl. in total): RRFB Pedestrian Crossing and Signage Assemblies	*4*	*EA*	*$6,000.00*	*$24,000*	
			Advance Warning Signage Assemblies	2	EA	$300.00	$600	
		Midblock Crossing #2	Raised Median Curbing (120' x8')	252	LF	$4.00	$1,008	**$19,881**
			Raised Median Excavation/Prep	53	CY	$25.00	$1,333	
			Raised Median Colored Concrete Pavers	880	SF	$12.00	$10,560	
			Concrete Flatwork for Median Crossing/Landing	80	SF	$11.00	$880	
			High Visibility Patterned/Paver Thermoplastic Crosswalk	500	SF	$8.00	$4,000	
			Thermoplastic Stop Bars in Travel Lanes	20	LF	$15.00	$300	
			Pedestrian Crossing Warning Signage Assemblies	4	EA	$300.00	$1,200	
			Optional ($ not incl. in total): RRFB Pedestrian Crossing and Signage Assemblies	*4*	*EA*	*$6,000.00*	*$24,000*	
			Advance Warning Signage Assemblies	2	EA	$300.00	$600	
		Optional: Radar Speed Detection	*Optional ($ not incl. in total): Radar Speed Feedback Sign Assemblies*	*4*	*EA*	*$5,000.00*	*$20,000*	
						Subtotal:	**$141,736**	
						Subtotal (Opt 1) (with 20% Contingency):	*$170,083*	
Malley Dr	Huron St	**Bike Lane Thermoplastic Striping**	Bike Lane Interior Stripe (Parking Side) (4")	6,800	LF	$3.39	$23,052	**$50,474**
			Bike Lane Exterior Stripe (6")	6,800	LF	$4.00	$27,200	
			Bike Lane Symbol	23	EA	$9.78	$222	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	6,800	LF	$0.59	$3,978	**$36,408**
			TWLTL Yellow Solid Stripe (4")	6,800	LF	$3.39	$23,052	
			TWLTL Yellow Dashed Stripe (4")	6,800	LF	$0.59	$3,978	
			TWLTL Double and Single Turn Arrow Symbols	18	EA	$300.00	$5,400	
						Subtotal:	**$86,882**	
						Subtotal (with 20% Contingency):	*$104,258*	
						Community Center Drive Total :	**$228,618**	
						Community Center Drive Total (with 20% Contingency):	*$274,341*	

2. Malley Drive West Concept Project

Section From	*Section To*	*Element*	*Sub-Element*	*Quantity*	*Unit*	*Unit Price*	*Sub-Element Cost*	*Element Cost*
Community Center Dr	Washington St	**Buffered Bike Lane Thermoplastic Striping**	Bike Lane Interior Stripe (Parking Side) (4")	5,600	LF	$3.39	$18,984	**$73,789**
			Bike Lane Exterior Stripe (6")	5,600	LF	$4.00	$22,400	
			Bike Lane Buffer Exterior Stripe (6")	5,600	LF	$4.00	$22,400	
			Bike Lane Buffer Hatching (8" Every 30')	8,400	LF	$0.72	$6,048	
			Bike Lane Symbol	19	EA	$212.00	$3,957	
		Travel and Turn Lane Thermoplastic Striping	TWLTL Yellow Solid Stripe (4")	5,600	LF	$3.39	$18,984	**$25,260**
			TWLTL Yellow Dashed Stripe (4")	5,600	LF	$0.59	$3,276	
			TWLTL or Left Turn Lane Arrow Symbols	10	EA	$300.00	$3,000	

Malley Drive West Total:	**$99,049**
Malley Drive West Total (with 20% Contingency):	*$118,859*

3. Washington Street Concept Project

Section From	*Section To*	*Element*	*Sub-Element*	*Quantity*	*Unit*	*Unit Price*	*Sub-Element Cost*	*Element Cost*
120th Ave	Sylvia Dr	**Reconstruction, Repaving, & Planting**	Remove Concrete Sidewalk	902	SY	$10.00	$9,020	**$258,434**
			Remove Concrete Driveway	220	SY	$12.00	$2,635	
			Remove Concrete Curb and Gutter	1,353	LF	$4.00	$5,412	
			Remove Raised Center Median	3,000	SF	$2.00	$6,000	
			Reconstruct Concrete Sidewalk (5')	752	SY	$40.00	$30,067	
			Saw Cut Concrete Sidewalk Joints (Every 5')	1,353	LF	$1.00	$1,353	
			Reconstruct Concrete Driveway Flared (7" Thick)	220	SF	$10.00	$2,196	
			Reconstruct Concrete Curb and Gutter	1,353	LF	$18.00	$24,354	
			Reconstruct Raised Center Median (Variable Width)	3,000	SF	$11.00	$33,000	
			New Planting/Landscaping b/t Roadway and Sidewalk (4')	5,412	SF	$5.00	$27,060	
			Rotomill (2")	7,222	SY	$2.00	$14,444	
			Hot Mix Asphalt (HMA) (1/2")	1,029	Ton	$95.00	$97,771	
			Emulsified Asphalt	7	Ton	$750.00	$5,123	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	2,540	LF	$0.59	$1,486	**$11,747**
			Turn Lane White Solid Stripe (8")	1,130	LF	$6.78	$7,661	
			Single Turn Arrow Symbols	13	LF	$200.00	$2,600	
						Subtotal:	**$270,181**	
						Subtotal (with 20% Contingency):	*$324,218*	
Sylvia Dr	115th Ave	**Reconstruction, Repaving, & Planting**	Remove Concrete Sidewalk	3,001	SY	$10.00	$30,007	**$751,535**
			Remove Concrete Driveway	126	SY	$12.00	$1,515	
			Remove Concrete Curb and Gutter	3,858	LF	$4.00	$15,432	
			Remove Raised Center Median	11,020	SF	$2.00	$22,040	
			Remove Raised Center Median Trees (Large)	2	EA	$100.00	$200	
			Reconstruct Concrete Sidewalk (10')	4,287	SY	$40.00	$171,467	
			Saw Cut Concrete Sidewalk Joints (Every 5')	7,716	LF	$1.00	$7,716	
			Reconstruct Concrete Driveway Flared (7" Thick)	126	SF	$10.00	$1,262	
			Reconstruct Concrete Curb and Gutter	3,858	LF	$18.00	$69,444	
			Reconstruct Raised Center Median (Variable Width)	11,020	SF	$11.00	$121,220	
			New Planting/Landscaping b/t Roadway and Sidewalk (5')	19,290	SF	$5.00	$96,450	
			Rotomill (2")	13,220	SY	$2.00	$26,440	
			Hot Mix Asphalt (HMA) (1/2")	1,884	Ton	$95.00	$178,966	
			Emulsified Asphalt	13	Ton	$750.00	$9,377	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	4,000	LF	$0.59	$2,340	**$8,784**
			Turn Lane White Solid Stripe (8")	685	LF	$6.78	$4,644	
			Single Turn Arrow Symbols	9	LF	$200.00	$1,800	
		117th Ave & Washington St Intersection Redesign*	Remove Concrete Sidewalk from North Side of 117th Ave	133	SY	$10.00	$1,333	**$75,592**
			Remove Concrete Curb and Gutter	200	LF	$4.00	$800	
			Remove Grass from North Side of 117th Ave	2,160	SF	$2.00	$4,320	
			Remove 117th Ave Raised Center Median	2,345	SF	$4.00	$9,380	
			Reconstruct Concrete Sidewalk (10') (Washington St East Side)	44	SY	$40.00	$1,778	
			Saw Cut Concrete Sidewalk Joints (Every 5')	80	LF	$1.00	$80	
			Reconstruct Concrete Sidewalk (8') (117th Ave North Side)	120	SY	$40.00	$4,800	
			Saw Cut Concrete Sidewalk Joints (Every 5')	280	LF	$1.00	$280	
			Reconstruct Concrete Curb and Gutter	200	LF	$18.00	$3,600	
			Reconstruct Shared Use Curb Ramps on Washington St	6	EA	$2,475.00	$14,850	
			Construct Extended Washington St Raised Center Median & Crossing					
			Raised Median Curbing (65' x13')	182	LF	$4.00	$728	
			Raised Median Colored Concrete Pavers	715	SF	$12.00	$8,580	
			Concrete Flatwork for Median Crossing/Landing	130	SF	$11.00	$1,430	
			High Visibility Continental Thermoplastic Crosswalk	48	LF	$30.00	$1,440	
			Thermoplastic Stop Bars in Travel Lanes	48	LF	$15.00	$720	
			Tactile Warning Strips in Raised Center Median (8' Wide)	2	EA	$300.00	$600	
			10' Extension from Roadway to Existing Sidewalk (Concrete)	10	LF	$47.50	$475	
			New Planting/Landscaping b/t Roadway and Sidewalk on North Side of 117th Ave (5')	1,080	SF	$5.00	$5,400	
			New Trees on North Side of 117th Ave	4	EA	$500.00	$2,000	
			Rotomill (2") on 117th Ave	800	SY	$2.00	$1,600	
			Hot Mix Asphalt (HMA) (1/2") on 117th Ave	114	Ton	$95.00	$10,830	
			Emulsified Asphalt on 117th Ave	1	Ton	$750.00	$567	

*costs do not include utility or street lighting relocation

Subtotal:	**$835,911**
Subtotal (with 20% Contingency):	*$1,003,093*

115th Ave	112th Ave	**Reconstruction, Repaving, & Planting**	Remove Concrete Sidewalk	4,810	SY	$10.00	$48,100	**$964,006**
			Remove Concrete Driveway	371	SY	$12.00	$4,453	
			Remove Concrete Curb and Gutter	4,329	LF	$4.00	$17,316	
			Remove Raised Center Median	14,471	SF	$2.00	$28,942	
			Remove Raised Center Median Trees (Large)	8	EA	$100.00	$800	
			Remove Raised Center Median Trees (Small)	5	EA	$50.00	$250	
			Reconstruct Concrete Sidewalk (12')	5,772	SY	$40.00	$230,880	
			Saw Cut Concrete Sidewalk Joints (Every 5')	3,463	LF	$1.00	$3,463	
			Reconstruct Concrete Driveway Flared (7" Thick)	371	SF	$10.00	$3,711	
			Reconstruct Concrete Curb and Gutter	4,329	LF	$18.00	$77,922	
			Reconstruct Raised Center Median (Variable Width)	14,471	SF	$11.00	$159,181	
			New Center Median Trees	13	EA	$900.00	$11,700	
			New Planting/Landscaping b/t Roadway and Sidewalk (9')	12,987	SF	$5.00	$64,935	
			Rotomill (2")	19,225	SY	$2.00	$38,451	
			Hot Mix Asphalt (HMA) (1/2")	2,740	Ton	$95.00	$260,264	
			Emulsified Asphalt	18	Ton	$750.00	$13,637	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	5,000	LF	$0.59	$2,925	**$20,187**
			Turn Lane White Solid Stripe (8")	2,074	LF	$6.78	$14,062	
			Single Turn Arrow Symbols	16	LF	$200.00	$3,200	
						Subtotal:	**$984,193**	
						Subtotal (with 20% Contingency):	*$1,181,031*	
112th Ave	108th Ave	**Reconstruction, Repaving, & Planting**	Remove Concrete Sidewalk	2,667	SY	$10.00	$26,667	**$753,749**
			Remove Concrete Curb and Gutter	2,400	LF	$4.00	$9,600	
			Remove Raised Center Median	6,440	SF	$2.00	$12,880	
			Reconstruct Concrete Sidewalk (10')	2,667	SY	$40.00	$106,667	
			Saw Cut Concrete Sidewalk Joints (Every 5')	5,333	LF	$1.00	$5,333	
			Reconstruct Concrete Curb and Gutter	2,400	LF	$18.00	$43,200	
			Reconstruct Raised Center Median (Variable Width)	23,240	SF	$11.00	$255,640	
			New Planting/Landscaping b/t Roadway and Sidewalk (9')	12,987	SF	$5.00	$64,935	
			Rotomill (2")	14,084	SY	$2.00	$28,169	
			Hot Mix Asphalt (HMA) (1/2")	2,007	Ton	$95.00	$190,668	
			Emulsified Asphalt	13	Ton	$750.00	$9,991	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	5,000	LF	$0.59	$2,925	**$9,472**
			Turn Lane White Solid Stripe (8")	630	LF	$6.78	$4,271	
			TWLTL Yellow Dashed Stripe (4")	170	LF	$0.59	$99	
			TWLTL Yellow Solid Stripe (4")	170	LF	$3.39	$576	
			Single Turn Arrow Symbols	8	LF	$200.00	$1,600	
						Subtotal:	**$763,221**	
						Subtotal (with 20% Contingency):	*$915,866*	
108th Ave	104th Ave	**Reconstruction, Repaving, & Planting**	Remove Concrete Sidewalk	3,294	SY	$10.00	$32,939	**$857,232**
			Remove Concrete Driveway	350	SY	$12.00	$4,200	
			Remove Concrete Curb and Gutter	4,235	LF	$4.00	$16,940	
			Remove Raised Center Median	4,620	SF	$2.00	$9,240	
			Reconstruct Concrete Sidewalk (10')	4,706	SY	$40.00	$188,222	
			Saw Cut Concrete Sidewalk Joints (Every 5')	2,886	LF	$1.00	$2,886	
			Reconstruct Concrete Driveway Flared (7" Thick)	350	SF	$10.00	$3,500	
			Reconstruct Concrete Curb and Gutter	4,235	LF	$18.00	$76,230	
			Reconstruct Raised Center Median (Variable Width)	13,470	SF	$11.00	$148,170	
			New Planting/Landscaping b/t Roadway and Sidewalk (5')	21,175	SF	$5.00	$105,875	
			Rotomill (2")	16,559	SY	$2.00	$33,118	
			Hot Mix Asphalt (HMA) (1/2")	2,360	Ton	$95.00	$224,166	
			Emulsified Asphalt	16	Ton	$750.00	$11,746	
		Travel and Turn Lane Thermoplastic Striping	Travel Lane White Dashed Stripe (4")	5,000	LF	$0.59	$2,925	**$12,630**
			Turn Lane White Solid Stripe (8")	1,048	LF	$6.78	$7,105	
			Single Turn Arrow Symbols	13	EA	$200.00	$2,600	
						Subtotal:	**$869,862**	
						Subtotal (with 20% Contingency):	*$1,043,834*	
						Washington Street Total:	**$3,723,369**	
						Washington Street Total (with 20% Contingency):	*$4,468,043*	

4. Melody Drive Concept Project

Section From	*Section To*	*Element*	*Sub-Element*	*Quantity*	*Unit*	*Unit Price*	*Sub-Element Cost*	*Element Cost*
		Repaving	Rotomill (2")	44,000	SY	$2.00	$88,000	**$714,860**
			Hot Mix Asphalt (HMA) (1/2")	6,270	Ton	$95.00	$595,650	
			Emulsified Asphalt	42	Ton	$750.00	$31,210	
		Buffered Bike Lane Thermoplastic Striping	Bike Lane Interior Stripe (Parking Side) (4")	13,200	LF	$3.39	$44,748	**$169,180**
			Bike Lane Exterior Stripe (6")	13,200	LF	$4.00	$52,800	
			Bike Lane Buffer Exterior Stripe (6")	13,200	LF	$4.00	$52,800	
			Bike Lane Buffer Hatching (8" Every 30')	13,200	LF	$0.72	$9,504	
			Bike Lane Symbol	44	EA	$212.00	$9,328	
104th Ave	Huron St	**Travel and Turn Lane Thermoplastic Striping**	TWLTL Yellow Solid Stripe (4")	13,200	LF	$3.39	$44,748	**$61,270**
			TWLTL Yellow Dashed Stripe (4")	13,200	LF	$0.59	$7,722	
			TWLTL Double and Single Turn Arrow Symbols	22	EA	$400.00	$8,800	
		Midblock Crossing	High Visibility Continental Thermoplastic Crosswalk	65	LF	$30.00	$1,950	**$6,063**
			Thermoplastic Stop Bar Lines in Travel Lanes	20	LF	$20.00	$400	
			Pedestrian Crossing Signage Assemblies	3	EA	$350.00	$1,050	
			Advance Warning Signage Assemblies	2	EA	$300.00	$600	
			Pedestrian Curb Ramp	1	EA	$2,062.50	$2,063	

Melody Drive Total:	**$951,373**
Melody Drive Total (with 20% Contingency):	*$1,141,648*

5. Irma Drive Concept Project

Section From	*Section To*	*Element*	*Sub-Element*	*Quantity*	*Unit*	*Unit Price*	*Sub-Element Cost*	*Element Cost*
		Buffered Bike Lane Thermoplastic Striping	Bike Lane Interior Stripe (Parking Side) (4")	11,200	LF	$3.39	$37,968	**$147,579**
			Bike Lane Exterior Stripe (6")	11,200	LF	$4.00	$44,800	
			Bike Lane Buffer Exterior Stripe (6")	11,200	LF	$4.00	$44,800	
			Bike Lane Buffer Hatching (8" Every 30')	16,800	LF	$0.72	$12,096	
			Bike Lane Symbol	37	EA	$212.00	$7,915	
		Travel and Turn Lane Thermoplastic Striping	TWLTL Yellow Solid Stripe (4")	11,200	LF	$3.39	$37,968	**$50,520**
			TWLTL Yellow Dashed Stripe (4")	11,200	LF	$0.59	$6,552	
			TWLTL Double and Single Turn Arrow Symbols	20	EA	$300.00	$6,000	
112th Ave	104th Ave	**Midblock Crossing**	Raised Median Curbing (120' x14')	276	LF	$4.00	$1,104	**$57,957**
			Raised Median Colored Concrete Pavers	1,540	SF	$12.00	$18,480	
			Concrete Flatwork for Median Crossing/Landing	140	SF	$11.00	$1,540	
			High Visibility Continental Thermoplastic Crosswalk	44	LF	$30.00	$1,320	
			Thermoplastic Stop Bars in Travel Lanes	20	LF	$15.00	$300	
			RRFB Pedestrian Crossing and Signage Assemblies	4	EA	$6,000.00	$24,000	
			Advance Warning Signage Assemblies	2	EA	$300.00	$600	
			Pedestrian Curb Ramp	2	EA	$4,950.00	$9,900	
			10' Trail Extension from Roadway to Existing Trail (Concrete)	15	LF	$47.50	$713	

Irma Drive Ttotal:	**$256,055**
Irma Drive Total (with 20% Contingency):	*$307,266*

CONNECT NORTHGLENN

Northglenn

BICYCLE AND PEDESTRIAN

MASTER PLAN

APPENDIX J:

ECONOMIC BENEFITS

CITY OF Northglenn

ECONOMIC BENEFITS

OF

WALK *and* BIKE FRIENDLY COMMUNITIES

WALKABLE COMMUNITIES ARE MORE RESILIENT

Households in automobile dependent communities have fewer ways to reduce their transportation costs in response to unexpected events, such as a job loss or fuel price spikes. The 2008 mortgage collapse took place on the auto-dominated suburban fringe, **while walkable communities, whether in the city or the suburbs, held their value.**

Source: Walk, Don't Drive, to Real Estate Recovery. 2011

WALK AND BIKE FRIENDLY COMMUNITIES ARE THE FUTURE

62%

of MILLENNIALS PREFER

LIVING IN THE TYPE OF

MIXED-USE COMMUNITIES

where they live in close proximity to a mix of shopping, restaurants, and offices, such as the planned civic campus.

Source: Millennials: Breaking the Myths, 2014

BICYCLING SAVES COLORADANS MONEY *AND* LIVES

PHYSICAL ACTIVITY RESULTING FROM BICYCLING IN COLORADO CURRENTLY

HELPS PREVENT ABOUT 50 DEATHS PER YEAR

Source: Economic and Health Benefits of Bicycling and Walking Report, State of Colorado, 2016

TRANSLATING TO

$511 MILLION

IN ANNUAL HEALTH BENEFITS

WALKING AND BIKING IS LOW TO NO COST

In the US, some trips are long and cannot be easily completed by walking or bicycling, but many daily trips are short. By shifting shorter trips to walking and bicycling, a significant savings can be realized annually:

40% OF ALL TRIPS ARE 2 MILES (OR LESS) *(Source: NHTS, 2009)*

Driving 4 miles/day costs **$847/YEAR** **IN FUEL AND VEHICLE WEAR AND TEAR** *(Source: AAA, 2015)*

WE WANT TO AGE IN PLACE - FOR OUR HAPPINESS AND WALLETS

89 percent of Americans over age 50 wish to remain in their homes for as long as possible. High nursing home costs mean that aging in place can yield significant cost savings for the elderly. From 2004 to 2007, the median monthly payment for noninstitutional long-term care was **$928 compared with $5,243 for nursing homes.** Walkable and bikeable communities enable people to age in place.

Source: : Kaye et al., 2010

TRANSIT ACCESS INCREASES PROPERTY VALUES

TRANSIT ORIENTED DEVELOPMENT (TOD)

noun | Tran·sit Or·ie·en·ted Dev·el·op·men·t

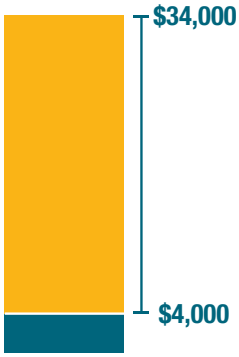
Mixed-use residential and commercial area **designed to maximize access to public transport**

247%

That's how much greater the average home value in a TOD was compared to the average home in the United States in 2014. This bodes well for planned TODs in Northglenn, including the planned 112th Ave Station Area. Improving walking and bicycling connections to these areas will help to maximize the City's return on investment.

(Source: TOD Index Report, 2014)

WALKABILITY PAYS OFF



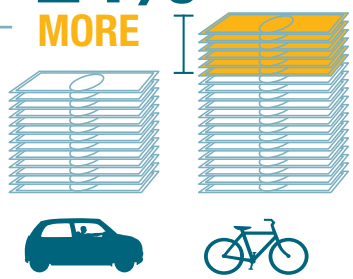
(Source: Cortright, 2009)

In a controlled study of 90,000 houses in 15 US metropolitan housing markets, **houses with the above-average levels of walkability were found to command a premium of about $4,000 to $34,000 over houses with just average levels of walkability.**

BICYCLISTS SPEND MORE

24% MORE

Customers who arrive by automobile spend the most per visit across all of the establishments, but cyclists spend the most per month.



(Source: Clifton, Morrissey & Ritter, 2012)